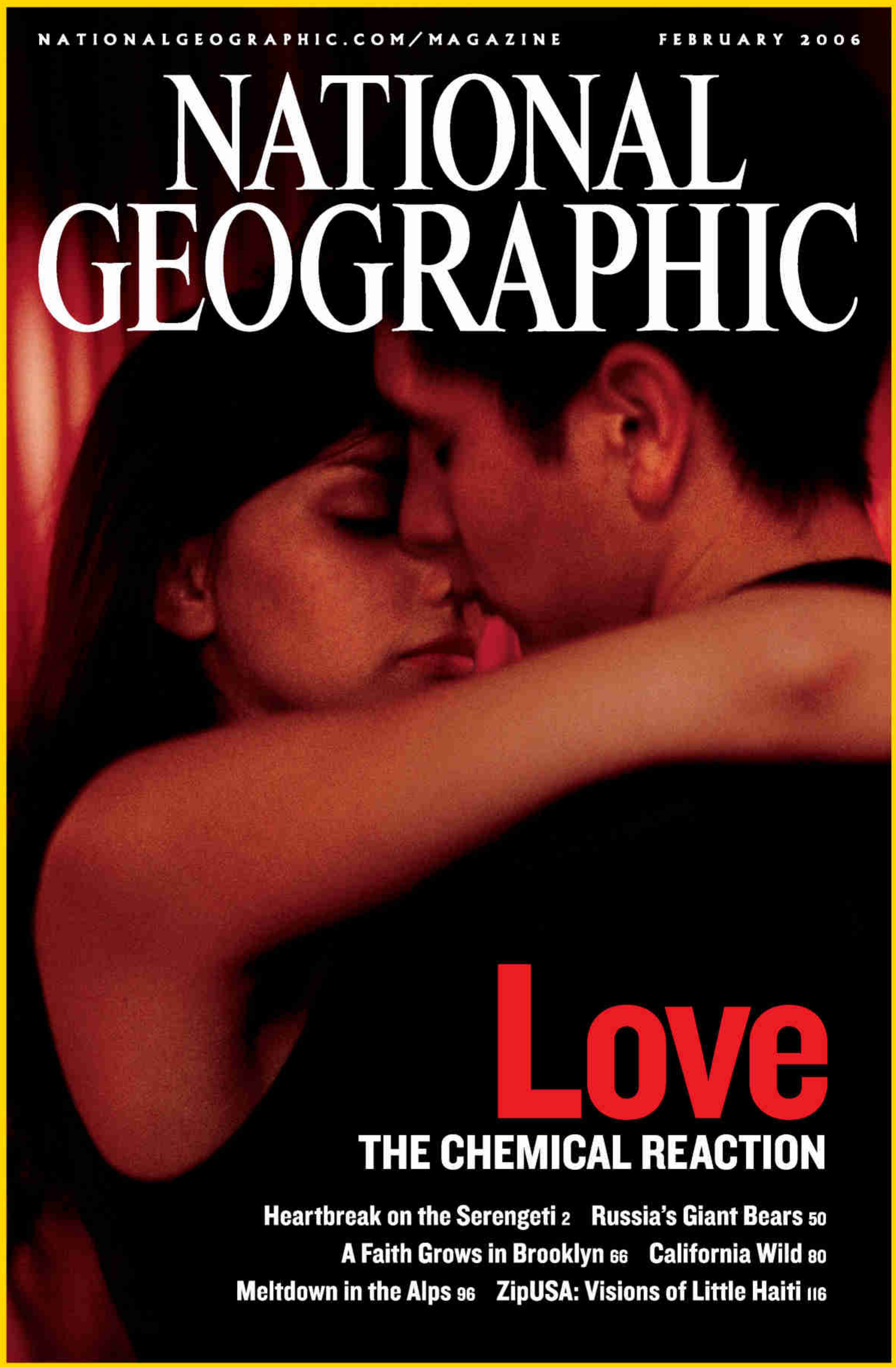
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NATIONAL GEOGRAPHIC



Love
THE CHEMICAL REACTION

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BY PABLO CORRAL VEGA

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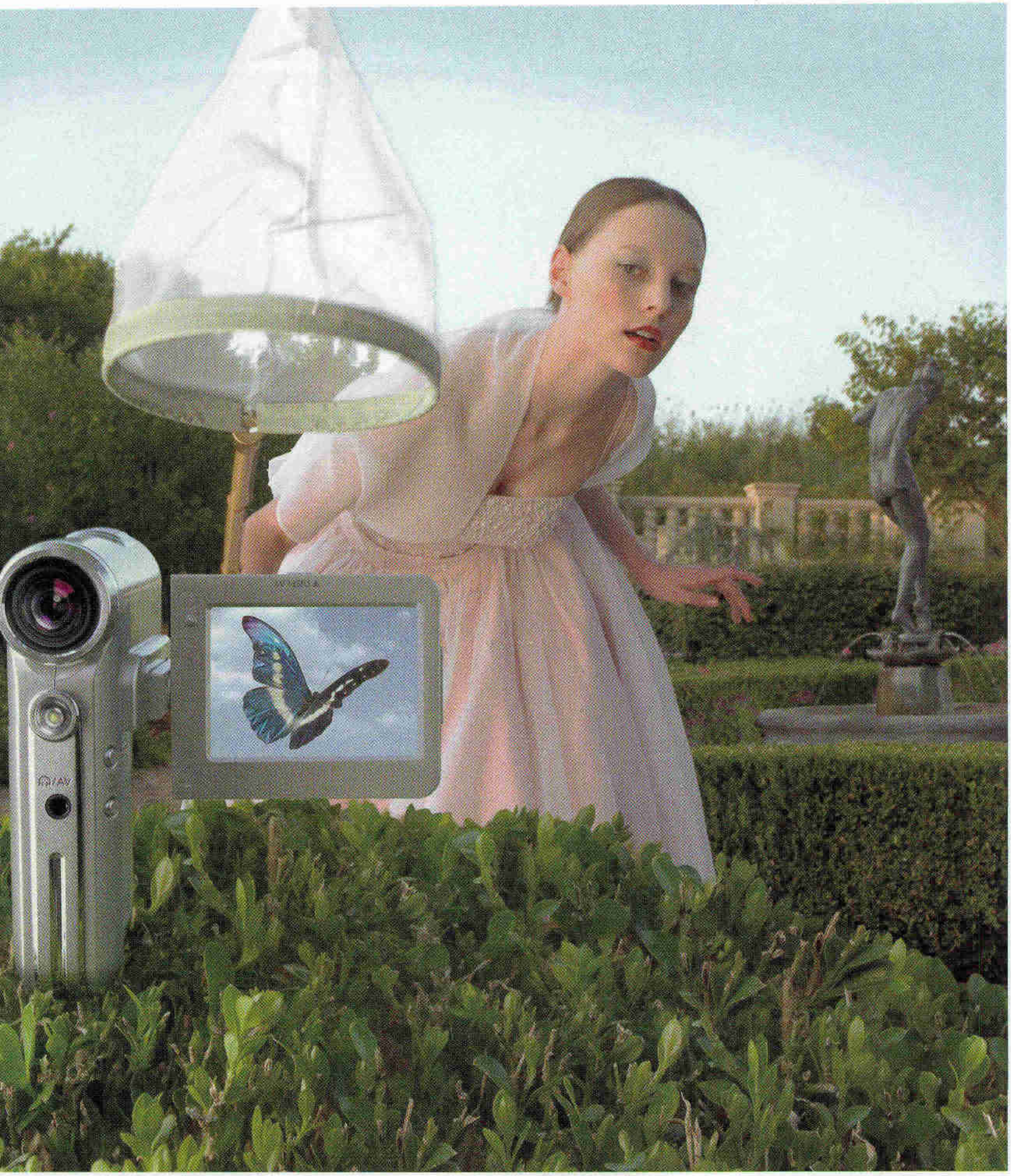
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From the Editor



MARILYN MONROE AND CLARK GABLE ON THE SET OF *THE MISFITS*. PHOTO: EVE ARNOLD, MAGNUM PHOTOS

To be madly in love could be exactly that—madness. The term "lovesick" is surprisingly accurate, explains writer Lauren Slater in this month's lead article. People experiencing romantic love, it turns out, have a chemical profile in their brains similar to that of people who suffer from obsessive-compulsive disorder. Love blurs the line between mental health and psychopathology.

Still, we can't resist the siren's song, and science has an explanation for that, too. Love, it seems, lights up certain areas of the brain and releases chemicals that provoke hyperactivity, recklessness, and exhilaration. That's why spellbound lovers stay up all night to see the sun rise, take extraordinary risks to see each other, or, as Britain's Edward VIII did, throw a whole country aside for "the woman I love." Love can be dangerous.

A counterweight to the heavy sorrows of the world, love is a joyful part of life and a worthy subject for these pages. Science can explain how love affects the brain—but not the mystery of how it affects the heart.



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Waved Albatross *(Phoebastria irrorata)*
Size: Length 72-90 cm; wingspan approx. 200 cm **Weight:** Up to 5 kg **Habitat:** Adults nest on south Espanola Island and perhaps on Isla de la Plata; during non-breeding season they move to the waters of the Ecuadorian and Peruvian continental shelf **Surviving number:** Estimated at 35,000

Photographed by Tui de Roy

WILDLIFE AS CANON SEES IT

Water, water everywhere, and just one place to breed. After months at sea, the male waved albatross makes landfall at its traditional breeding ground. And waits. When the female finally arrives, a complex courtship ritual begins: both birds bow, nod, duck, rattle their bills and circle their bill tips together. The whole performance is punctuated by screams, moans, sighs and trumpeting sounds. The strong bond they form perseveres as they hatch and take turns feeding their chick. The giant bird's fishing expeditions, however, are becoming more perilous all the time as the risk grows of tangling with a longline fishing operation.

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Naked Science

This 13-part series tackles some of the most fascinating subjects of our time, from the challenge of sending humans to distant planets to the latest developments in tsunami forecasting. Other episodes will delve into the chemistry of sexual attraction, investigate how to make volcanoes such as Mount Seeru in Indonesia (above) less deadly to humans, and imagine how life on Earth might have developed without a moon.

TUESDAYS AT 8 P.M. ET/PT

MegaStructures

Live large this winter. In its new season, *MegaStructures* trains its lens on the audacious people and plans behind super-size buildings and machines.

Tune in to track the construction of Kingda Ka, a 45-story roller coaster in New Jersey that takes riders from zero to 128 miles an hour in 3.5 seconds. And decide whether a satellite launching pad in the middle of the ocean is really worth its billion-dollar price tag.

MegaStructures reveals what makes a military command center impervious to nuclear attack, goes behind the scenes at the most technologically advanced raceway in the world, and looks deep inside the Navy's newest nuclear-powered submarine.

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INTERVIEW **Explore Japan, China, and India** with photographer Jodi Cobb, and examine the many faces of love in multimedia. ■ **VIDEO** See the giant brown bears that roam Russia's Kamchatka Peninsula. ■ **PHOTO OF THE MONTH** Sign up for an e-newsletter featuring photos, desktop wallpaper, and more at ***ngm.com/0602.***

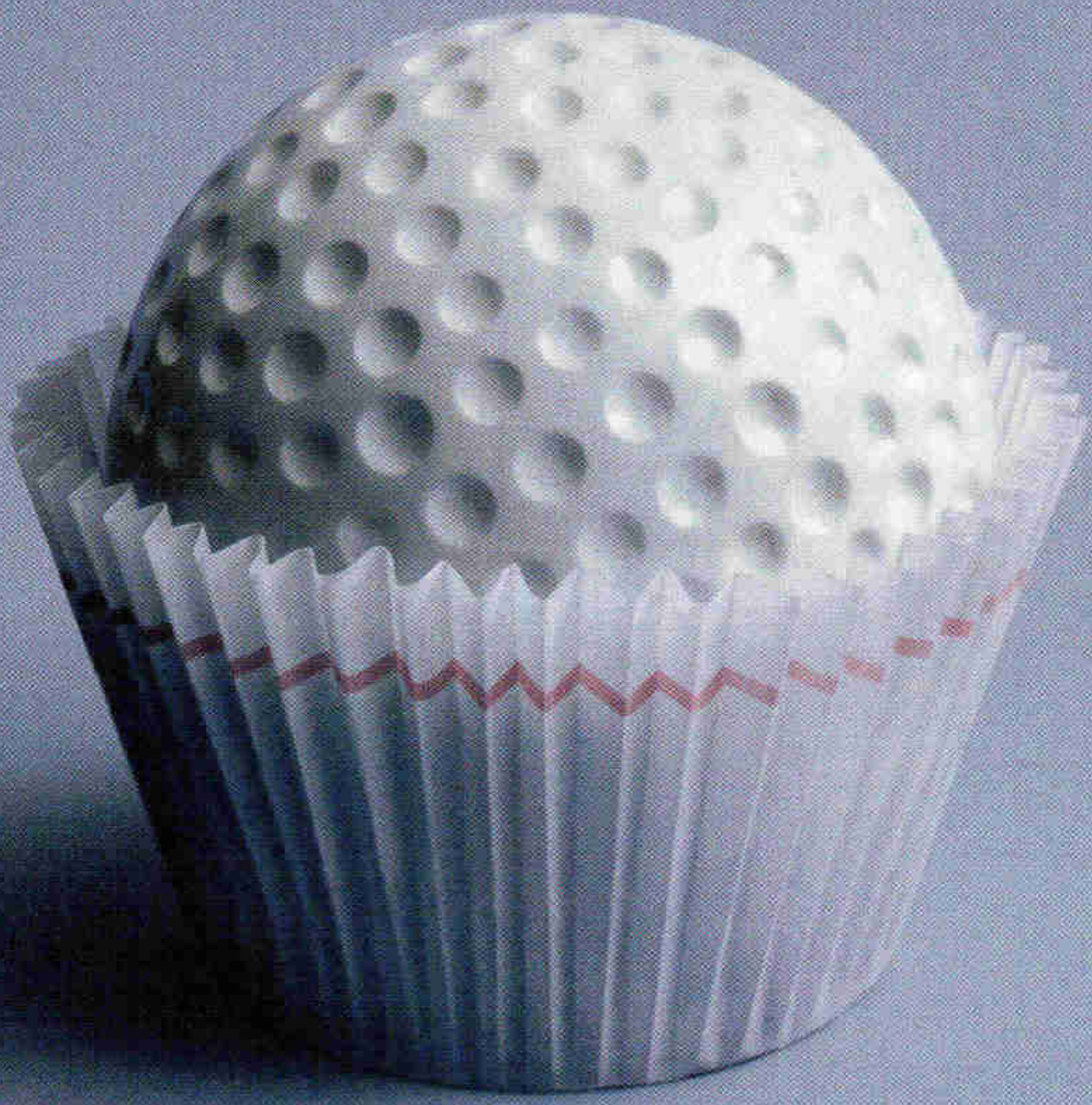
IMAGES OF AUSTRALIA **See photographer Annie Griffiths Belt's newest photos,** taken during her December trip with last year's *nationalgeographic.com* sweepstakes winner. ■ **2006 BEST OF AUSTRALIA SWEEPSTAKES** The winner will spend 17 days down under and meet with a top shark expert. See full official rules and enter online at ***nationalgeographic.com/travelaustralia.***

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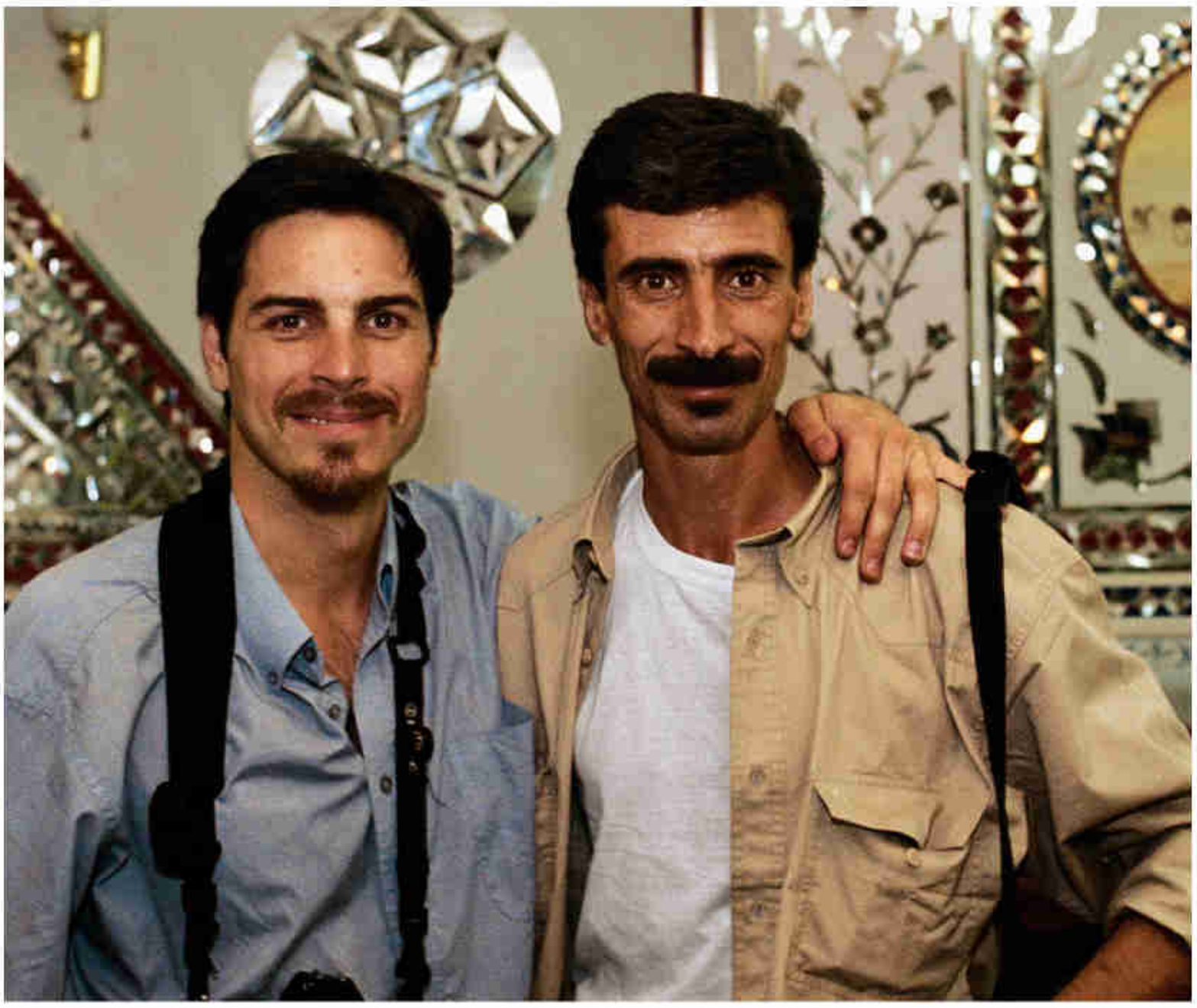
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Behind the Scenes



IN MEMORIAM

A Death in Iraq

One of the first times Matt Moyer (above, at left) worked with Fakher Haider, at right, Haider saved Moyer's life—putting himself between the American photographer and the muzzle of an AK-47, then persuading the gunman to move along. "Fakher once told me, 'If one drop of your blood is spilled, it is as if my blood is being spilled,'" says Moyer. "For him, these were not just words."

On September 19, 2005, on the outskirts of Basra, Haider—a journalist and consultant with organizations including the *New York Times* and the *Guardian* of London—was found dead. He'd been abducted by a group of men who'd identified themselves as police officers.

He will be remembered for his deep understanding of his country, says Moyer, who worked with Haider on the June 2004 article "The Shiites of Iraq." And he'll be remembered as a friend. Moyer last spoke with him in early September, when Haider called after Hurricane Katrina. "Here is a guy living in one of the most dangerous places on Earth checking to see if I was OK," Moyer says. "He was always looking out for others." A fund for Haider's wife and children has been established. Checks may be made out to the *New York Times*, with "Haider Fund" in the memo field. Send to Cynthia Latimer, *New York Times*, 229 W. 43rd St., Foreign Desk, 3rd Floor, New York, NY 10036.

GEOGRAPHY

On the Civil Rights Trail

From the National Voting Rights Museum in Selma to the 16th Street Baptist Church in Birmingham, teachers from the District of Columbia Geographic Alliance toured the Alabama route of the civil rights movement and met with some of its original foot soldiers last March. Since then—inspired by their trip and the need for more classroom materials on civil rights history—the teachers have produced lesson plans and a four-part video series. Their group is part of National Geographic's Education Foundation. Since 1986 the organization has spread geographic knowledge to over 100,000 teachers across the country.

Calendar

FEBRUARY

"Tutankhamun and the Golden Age of Pharaohs" exhibit. See items from Tut's tomb (including the bust below) now at Florida's Fort Lauderdale Museum of Art. For tickets, call 1-877-TUT-TKTS or go to *kingtut.org*.

National Geographic Live! To see the spring event schedule and order tickets to National Geographic events (such as those by conservationist Michael Fay and dinosaur hunter Paul Sereno) go to *nationalgeographic.com/nglive*. Or call 206-624-5677 in Seattle; 312-665-7400 in Chicago; or 612-673-0404 in Minneapolis.

10 **"Mongolia: Traditions Reborn"** exhibit. Experience Mongolia's cultural renaissance. See elaborate Tsam masks and other traditional works of art. National Geographic Museum, Washington, D.C.

23 **"From Geisha to Diva"** exhibit. View the exquisite kimono collection of Japanese geisha-turned-performer Ichimaru. National Geographic Museum, Washington, D.C.



Calendar dates are accurate at press time; please go to *national geographic.com* or call 1-800-NGS-LINE (647-5463) for more information.

MATT MOYER (TOP); KENNETH GARRETT

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From the President



Society President John Fahey, at left, and Chairman Gilbert M. Grosvenor review the Hurricane Katrina special edition.

One of geography's greatest powers is its capacity to explain the past and predict the future. NATIONAL GEOGRAPHIC foretold with deadly precision the events that would transpire along the U.S. Gulf Coast when a hurricane like Katrina hit. Now geography will also play a key role in the region's reconstruction: informing decisions about rebuilding neighborhoods, protecting the region's energy assets, and helping to prevent such disasters in the future.

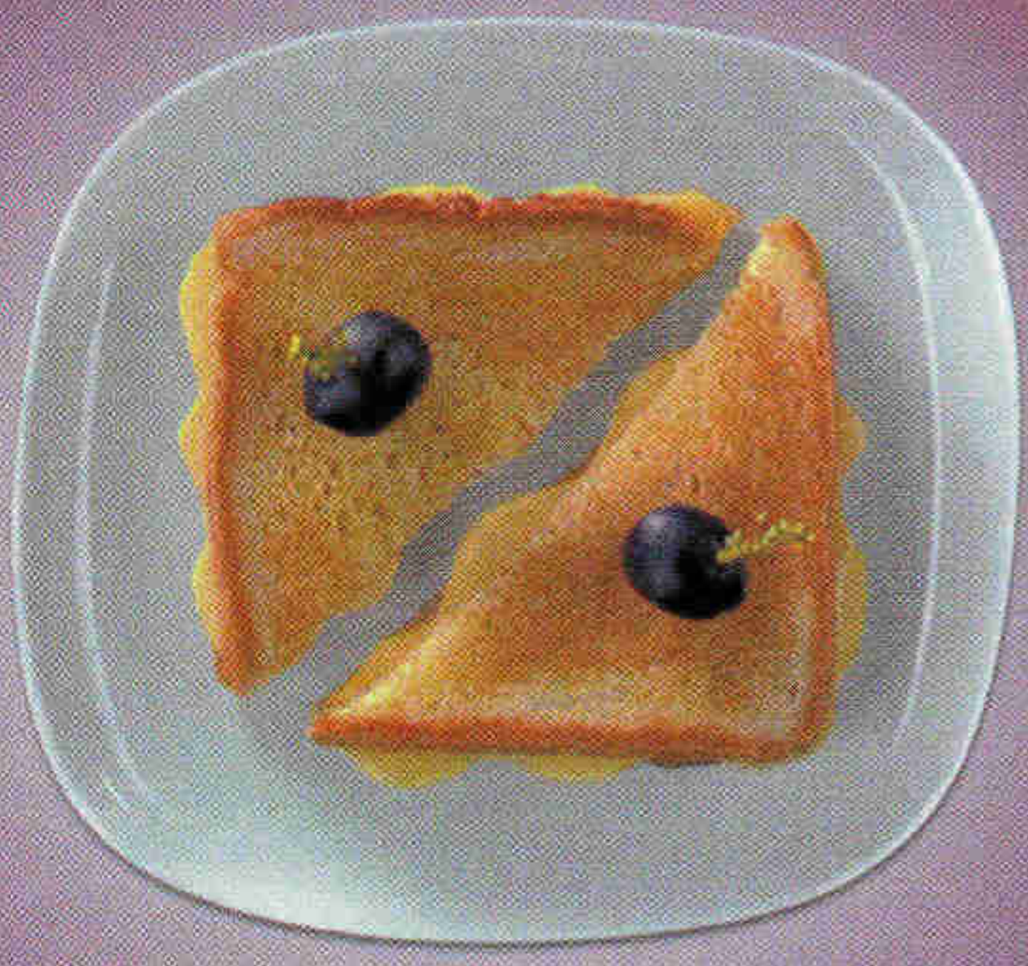
Not long ago National Geographic surveyed the geographic knowledge of American students along with the youth of eight other nations; the U.S. finished next to last. The urgency of National Geographic's mission has never been so clear. Our children's future challenges—dealing with global warming, finding new and sustainable energy sources, confronting terrorism—will all be affected by geography.

If geographic literacy is embraced as an important subject, tomorrow's leaders will be better prepared to reconcile the essential bond between people and place. Everything we do at National Geographic is intended to advance this cause, and members like you are our greatest asset. All of us must play an active role. There is inevitable tension in the relationship between human aspirations and the natural world. Our future depends on how well we manage that relationship.



NATIONAL GEOGRAPHIC PHOTOGRAPHER MARK THIESSEN

VYTORIN treats the 2 sources of cholesterol.



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You probably know that cholesterol comes from food. But what you might not know is that your cholesterol has a lot to do with your family history. VYTORIN treats both sources of cholesterol.

A healthy diet is important, but when it's not enough, adding VYTORIN can help. VYTORIN helps block the absorption of cholesterol that comes from food and reduces the cholesterol that your body makes naturally.

In clinical trials, VYTORIN lowered bad cholesterol more than Lipitor alone. VYTORIN is a tablet containing two medicines: Zetia® (ezetimibe) and Zocor (simvastatin).

Important information: VYTORIN is a prescription tablet and isn't right for everyone, including women who are nursing or pregnant or who may become pregnant, and anyone with liver problems. Unexplained muscle pain or weakness could be a sign of a rare but serious side effect and should be reported to your doctor right away. VYTORIN may interact with other medicines or certain foods, increasing your risk of getting this serious side effect. So, tell your doctor about any other medications you are taking.

To learn more, call 1-877-VYTORIN or visit vytorin.com. Please read the Patient Product Information on the adjacent page.

Continue to follow a healthy diet, and ask your doctor about adding VYTORIN.

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(ezetimibe/simvastatin)

Treat the 2 sources of cholesterol.

VYTORIN® (ezetimibe/simvastatin) Tablets

Patient Information about VYTORIN (VI-tor-in)
Generic name: ezetimibe/simvastatin tablets

Read this information carefully before you start taking VYTORIN. Review this information each time you refill your prescription for VYTORIN as there may be new information. This information does not take the place of talking with your doctor about your medical condition or your treatment. If you have any questions about VYTORIN, ask your doctor. Only your doctor can determine if VYTORIN is right for you.

What is VYTORIN?

VYTORIN is a medicine used to lower levels of total cholesterol, LDL (bad) cholesterol, and fatty substances called triglycerides in the blood. In addition, VYTORIN raises levels of HDL (good) cholesterol. It is used for patients who cannot control their cholesterol levels by diet alone. You should stay on a cholesterol-lowering diet while taking this medicine.

VYTORIN works to reduce your cholesterol in two ways. It reduces the cholesterol absorbed in your digestive tract, as well as the cholesterol your body makes by itself. VYTORIN does not help you lose weight.

Who should not take VYTORIN?

Do not take VYTORIN:

- If you are allergic to ezetimibe or simvastatin, the active ingredients in VYTORIN, or to the inactive ingredients. For a list of inactive ingredients, see the "Inactive ingredients" section at the end of this information sheet.
- If you have active liver disease or repeated blood tests indicating possible liver problems.
- If you are pregnant, or think you may be pregnant, or planning to become pregnant or breast-feeding.

VYTORIN is not recommended for use in children under 10 years of age.

What should I tell my doctor before and while taking VYTORIN?

Tell your doctor right away if you experience unexplained muscle pain, tenderness, or weakness. This is because on rare occasions, muscle problems can be serious, including muscle break-down resulting in kidney damage.

The risk of muscle breakdown is greater at higher doses of VYTORIN.

The risk of muscle breakdown is greater in patients with kidney problems.

Taking VYTORIN with certain substances can increase the risk of muscle problems. It is particularly important to tell your doctor if you are taking any of the following:

- cyclosporine
- danazol
- antifungal agents (such as itraconazole or ketoconazole)
- fibric acid derivatives (such as gemfibrozil, bezafibrate, or fenofibrate)
- the antibiotics erythromycin, clarithromycin, and telithromycin
- HIV protease inhibitors (such as indinavir, nelfinavir, ritonavir, and saquinavir)
- the antidepressant nefazodone
- amiodarone (a drug used to treat an irregular heartbeat)
- verapamil (a drug used to treat high blood pressure, chest pain associated with heart disease, or other heart conditions)
- large doses (≥1-g/day) of niacin or nicotinic acid
- large quantities of grapefruit juice (>1 quart daily)

It is also important to tell your doctor if you are taking coumarin anticoagulants (drugs that prevent blood clots, such as warfarin).

Tell your doctor about any prescription and nonprescription medicines you are taking or plan to take, including natural or herbal remedies.

Tell your doctor about all your medical conditions including allergies.

Tell your doctor if you:

- drink substantial quantities of alcohol or ever had liver problems. VYTORIN may not be right for you.
- are pregnant or plan to become pregnant. Do not use VYTORIN if you are pregnant, trying to become pregnant or suspect that you are pregnant. If you become pregnant while taking VYTORIN, stop taking it and contact your doctor immediately.
- are breast-feeding. Do not use VYTORIN if you are breast-feeding.

Tell other doctors prescribing a new medication that you are taking VYTORIN.

How should I take VYTORIN?

- Take VYTORIN once a day, in the evening, with or without food.
- Try to take VYTORIN as prescribed. If you miss a dose, do not take an extra dose. Just resume your usual schedule.
- Continue to follow a cholesterol-lowering diet while taking VYTORIN. Ask your doctor if you need diet information.
- Keep taking VYTORIN unless your doctor tells you to stop. If you stop taking VYTORIN, your cholesterol may rise again.

What should I do in case of an overdose?

Contact your doctor immediately.

What are the possible side effects of VYTORIN?

See your doctor regularly to check your cholesterol level and to check for side effects. Your doctor may do blood tests to check your liver before you start taking VYTORIN and during treatment.

In clinical studies patients reported the following common side effects while taking VYTORIN: headache and muscle pain (see What should I tell my doctor before and while taking VYTORIN?).

The following side effects have been reported in general use with either ezetimibe or simvastatin tablets (tablets that contain the active ingredients of VYTORIN):

- allergic reactions including swelling of the face, lips, tongue, and/or throat that may cause difficulty in breathing or swallowing (which may require treatment right away), rash, hives; joint pain; alterations in some laboratory blood tests; liver problems; inflammation of the pancreas; nausea; gallstones; inflammation of the gallbladder.

Tell your doctor if you are having these or any other medical problems while on VYTORIN. This is <u>not</u> a complete list of side effects. For a complete list, ask your doctor or pharmacist.

General Information about VYTORIN

Medicines are sometimes prescribed for conditions that are not mentioned in patient information leaflets. Do not use VYTORIN for a condition for which it was not prescribed. Do not give VYTORIN to other people, even if they have the same condition you have. It may harm them.

This summarizes the most important information about VYTORIN. If you would like more information, talk with your doctor. You can ask your pharmacist or doctor for information about VYTORIN that is written for health professionals. For additional information, visit the following web site: vytorin.com.

Inactive ingredients:
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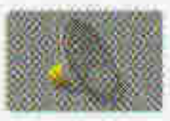
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Visions of Earth

ARIPUANÃ RIVER, BRAZIL

Nature's forces mingle as thousands of great dusky swifts dart in and out of Dardanelos Falls in the Amazon Basin. The birds nest on rocky ledges behind the wall of water. When our helicopter disturbed them into frantic flight over the thundering 426-foot falls, I was at first paralyzed by the sight. Then I quickly began to shoot. —*Sérgio Brant Rocha*

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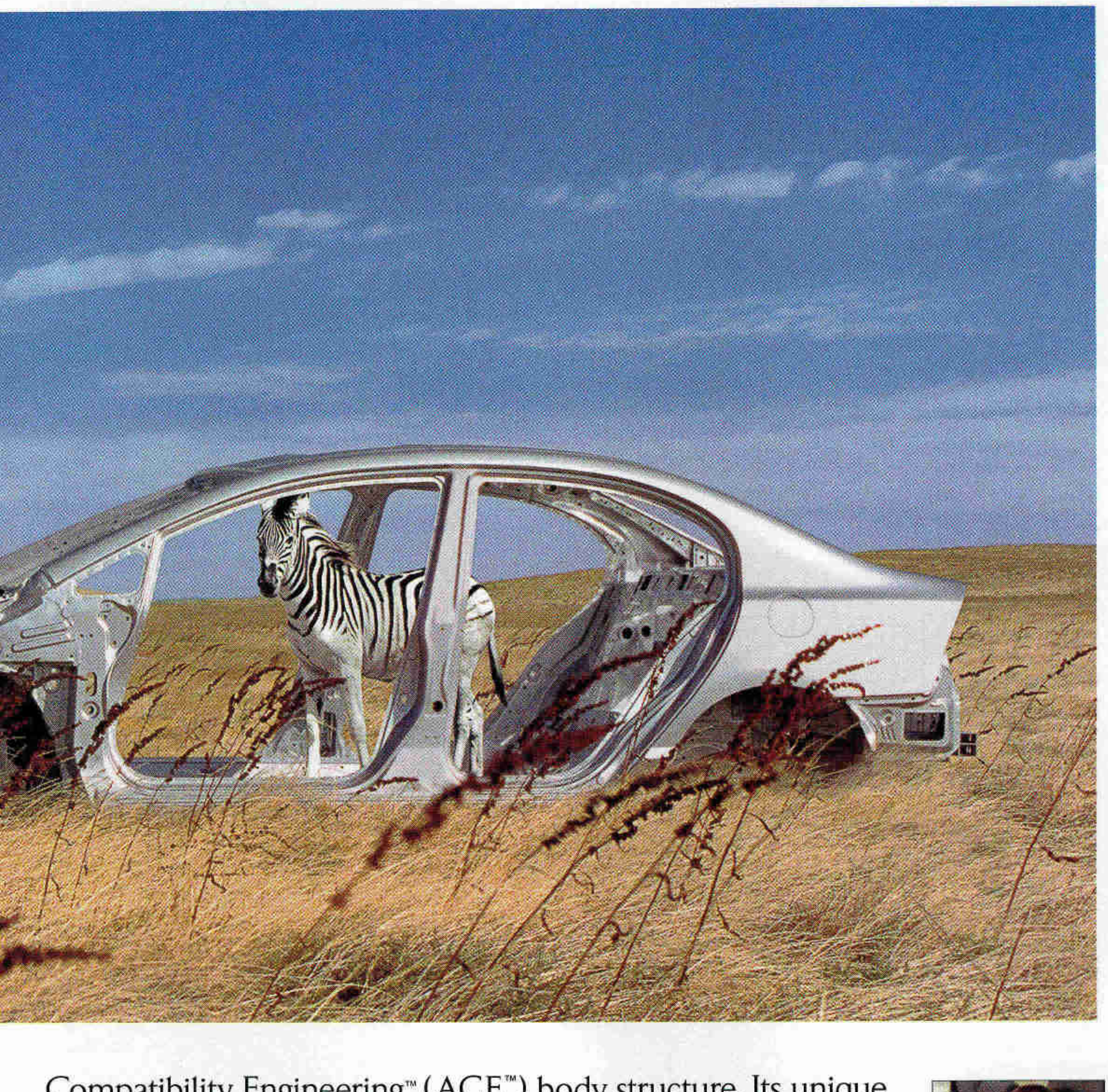
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Forum



October 2005
Letter writers this month responded to our articles on health and history. Struck by the story "Tracking the Next Killer Flu," readers offered suggestions on how to curtail the flu's spread and pondered ways the U.S. can get ready. History buffs wrote about the Battle of Trafalgar, praising Admiral Nelson and offering explanations for his naval tactics.

Tracking the Next Killer Flu

Once again I have received reliable information from NATIONAL GEOGRAPHIC before it appeared in the news media. Thank you so much for keeping your readers abreast of so many vital facts about our world.

NANCY C. HARDIN
Dyersburg, Tennessee

Although science is advancing on many fronts and clinicians actively seek to develop a vaccine for the flu, we know the best way to prevent the spread of disease already. Thanks to Florence Nightingale, hygiene and observances of precautions such as wearing gloves when bodily fluids are likely to be encountered are integral lessons taught in medical education curricula.

HOLLY PHILPOT
Nurse-practitioner
Athens, Georgia

FROM OUR ONLINE FORUM
ngm.com/0510

I know the U.S. government has allocated a large amount of money to prepare for a possible bird flu pandemic. I certainly hope some of this money will go straight to Vietnam and Thailand to pay farmers full market value for slaughtered poultry so they don't have an incentive to hide sick birds. It is far better to nip the virus in the bud than wait until it reaches America's shores and has mutated to a point where it can spread like wildfire (not to mention all the Asian lives it would save).

CATHERINE ARNE
Bethlehem, Pennsylvania

FROM OUR ONLINE FORUM
ngm.com/0510

Fatal Victory

Your article is magnificent. It is by far the most gripping, unvarnished story of the Battle of Trafalgar I have ever read. Kudos to Simon Worrall's detailed and exciting description of the action during the battle. I felt like I was there witnessing the death of Nelson.

FRANK MEIER
Osprey, Florida

Simon Worrall describes Nelson's innovative tactic for winning the Battle of Trafalgar accurately, but it is not "crossing the T." If your

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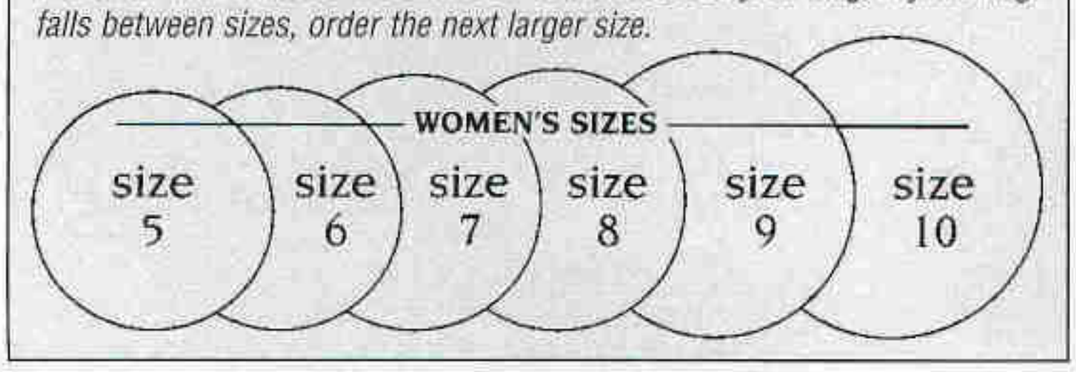
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WILLIAM ALBERT ALLARD

Thailand's Elephants

It is estimated that within 45 years there will be no viable Asian elephant population left. In general, governments and people turn a blind eye to this drastic decline of elephants. The abuse these intelligent animals have suffered is unconscionable considering they have built countries, have continuing economic impact, and are religious icons. People and governments need to wake up and develop solid plans of action. Apathy is the freeway to extinction.

CONNIE SPEIGHT
Founder, Elephants Umbrella Fund
Santa Barbara, California

Humans and elephants share a long cooperative history in Thailand. Are there some people who exploit that relationship? Of course. However, for the most part, elephants are highly respected and valued in Thailand. If you really want to see elephants living under the worst possible circumstances, you need only visit a zoo.

PAT BOYLE
Alexandria, Virginia

FROM OUR ONLINE FORUM
ngm.com/0510

According to the initiative of Her Majesty Queen Sirikit, the Elephant Reintroduction Foundation has been set up for captive elephants. The foundation works with the Forestry Department to establish elephant sanctuaries in suitable uninhabited forests. It is a pleasure to report that the elephants presently in our care and in the process of reintroduction into their natural habitat seem very healthy and happy.

SIVAPORN DARDARANANDA
Elephant Reintroduction Foundation
Bangkok, Thailand

FROM OUR ONLINE FORUM
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fleet crosses your opponent's T, it is the bar of the T, so all your ships can fire on the nearest ships of your opponent's line while they cannot fire on yours—clearly a tactically advantageous position. The surprise of Nelson's tactic was that it enabled the French and Spanish to cross his T. He correctly calculated that his opponents' inferior morale and training would deny them the advantage their position should have given them.

JEREMY BATEMAN
Lancaster, Lancastershire

Nelson was indeed taking a big chance by letting his enemies cross his T. But once he broke through the Spanish and French line, the tables were turned.

The article on Nelson and the Battle of Trafalgar was so well written, it really brought the chaos of the engagement to life. But I have a question. How could George IV have served with Nelson as a young man, when George III would not let his eldest son enter service abroad? Was it not the Prince of Wales's brother William, Duke of Clarence, who was a navy man and who served with Nelson in the West Indies?

JEAN ANN SMITH
Berkeley, California

In fact, it was not George IV who served with Nelson, but his younger brother William, who became William IV in 1830.

Hawaii's Outer Kingdom

I was in the Coast Guard and had the unique opportunity to be stationed on Kure Atoll, Hawaii, back in 1985 and 1986. Reading the article and seeing the photographs of the sooty terns, the booby, and Kure's emerald green lagoon brought back many fond memories of living in a real NATIONAL GEOGRAPHIC setting. Your article was brief in words but spoke volumes to me in the pictures.

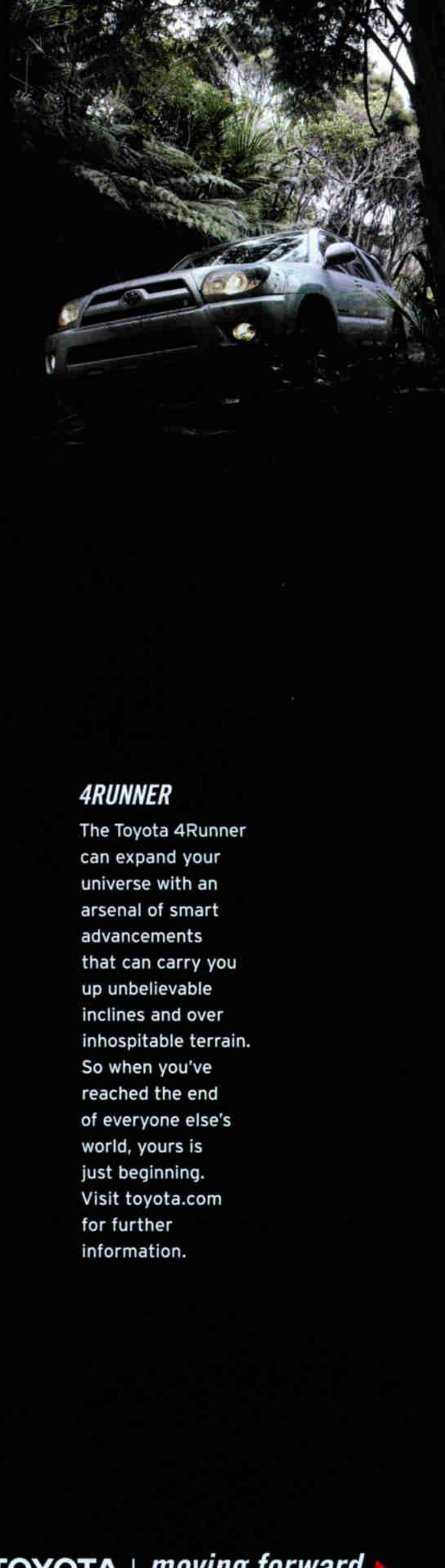
ROBERT L. OLIVER
Titusville, Florida

The assortment of debris on pages 86-7 from the stomach of an albatross chick includes an item with the designation VP-101. Knowing that this is the type

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of identifier for U.S. Navy patrol squadrons, I did an Internet search that reveals that VP-101 was an active unit during World War II in the Pacific theater and was renamed on October 1, 1944. Is it likely that this item has been floating in the Pacific for over 60 years?

MARK PESTANA
Tehachapi, California

According to the Navy Historical Center, the object appears to be a tag, possibly made of molded plastic called Bakelite, that was used to identify equipment for World War II Navy patrol squadron VP-101. Oceanographer and flotsam expert Curtis Ebbesmeyer says it is not unheard of for objects to float in the ocean for half a century before making it to shore. For instance, he found two items —a glass ball from 1955 and a rubber ball decorated with a late 1940s Warner Bros. cartoon— that washed ashore in 2003.

I have never seen a picture that has had such an impact on me as pages 86-7. This must not be *Homo sapiens'* enduring legacy for the planet. My trash will be saved and recycled. I will never throw away inorganic materials again.

EDMOND SHIPMAN
Bismarck, Missouri

ZipUSA: Bridgewater, New Jersey

The article on multiple births shows lovely, healthy toddlers and implies that low birth weight was their only potential problem. Unfortunately, fertility programs have also brought many, many heartaches. Assuming the babies survive to be born, they may have been damaged in the womb by whatever condition made pregnancy difficult in the first place. Certain childhood cancers, for example, appear to occur more frequently. Taking this route to parenthood is not a decision to be made through rose-colored glasses. Even the world's best neonatal units and pediatricians can only try to prevent nature from taking its course.

GLORIA J. KOHUT
Pediatric pathologist
Grand Rapids, Michigan

Geographica: Color of Money

As a paper money collector, I am delighted by your money feature. However, the statement that Elizabeth II "became the

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first royal ever featured on English paper money" would be more accurately stated as "the first royal ever featured on a Bank of England note." King George V was featured on ten-shilling and one-pound Treasury notes issued by the Lords Commissioners of His Majesty's Treasury from 1914 to 1928. That was the only time, other than British Military Authority notes and British Armed Forces special vouchers, that English paper money was issued by the British government rather than by the quasi-private Bank of England. Although initiated as an emergency measure during World War I, the Treasury notes continued to be issued until the Bank of England could be persuaded to end a century-long tradition of not issuing any denomination less than five pounds.

GREG FRANCK-WEIBY
Silverton, Oregon

Geographica: Free Love, Not Land

To my joy, an article in this issue displays one of my murals, painted in Copenhagen in 1992. I'm happy that my artwork appears in your esteemed magazine, which I've collected since my youth. The mural was signed with my name and is titled "The Wishing Tree."

MARIANNA RYDVALD
Phoenicia, New York

Who Knew?

I found the brief review on emerging technologies in refrigeration fascinating, including the reference to the zeer pot. The ranchers and cowboys of the American West used a similar concept when they stored meat inside a cubical burlap and chicken wire enclosure topped off with a slowly dripping coffee can of water. The water dripped into the burlap, resulting in the same evaporative cooling as the zeer pot. I know that a similar device was used in the Australian outback, and it wouldn't surprise me in the least to find out that various evaporative contraptions have been used for centuries.

WALTER DALITSCH III
Naples, Italy

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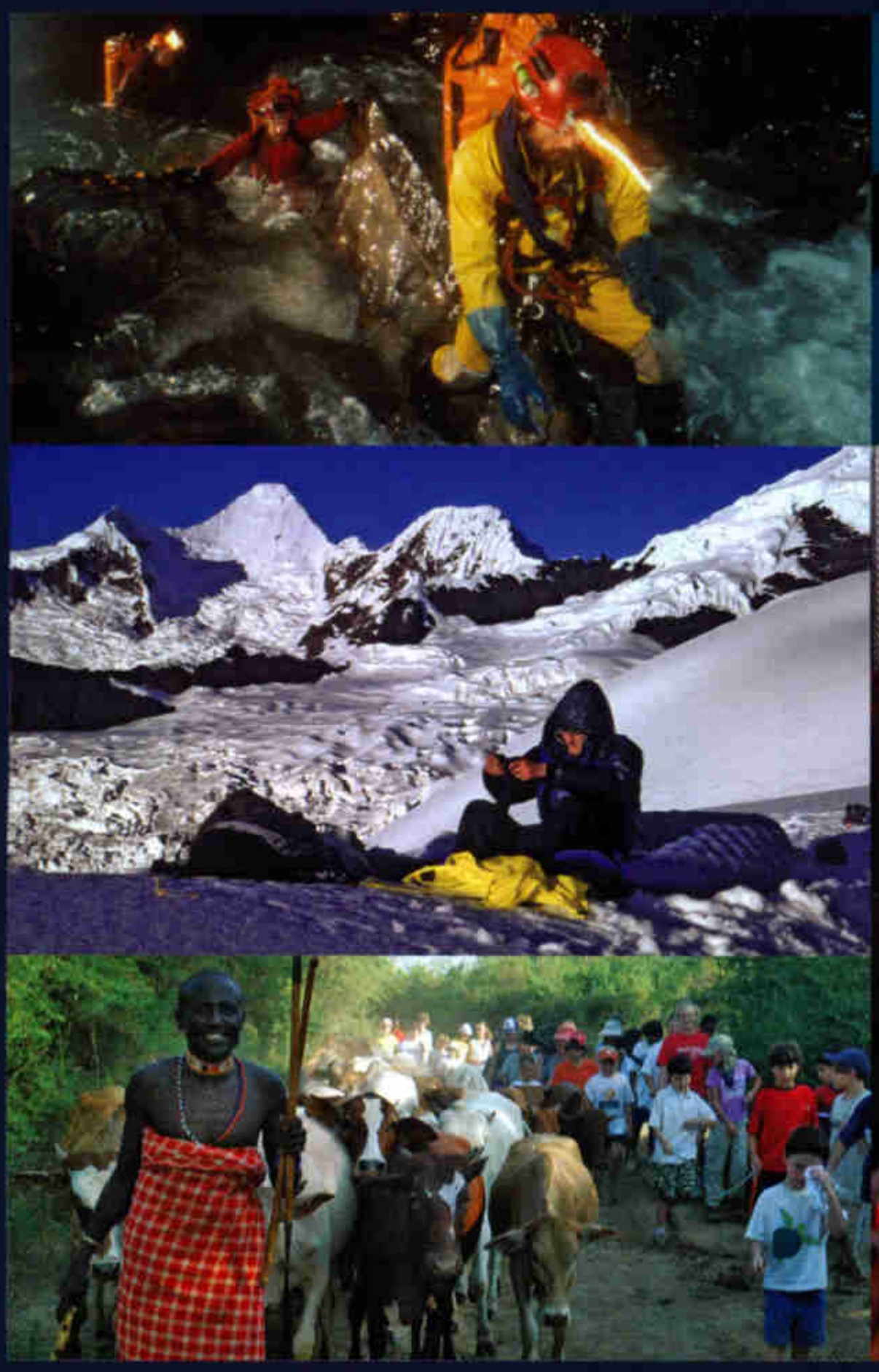
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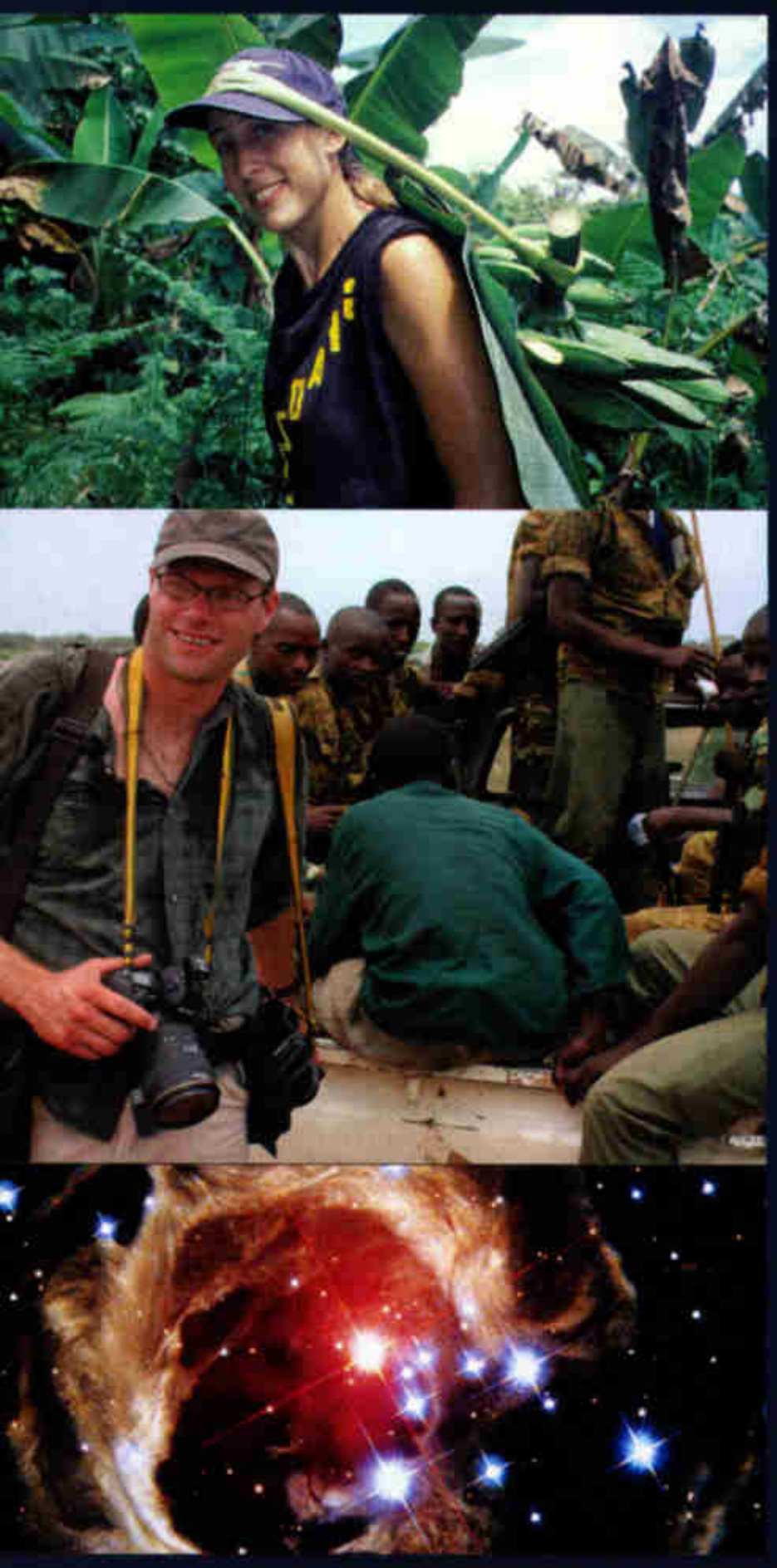


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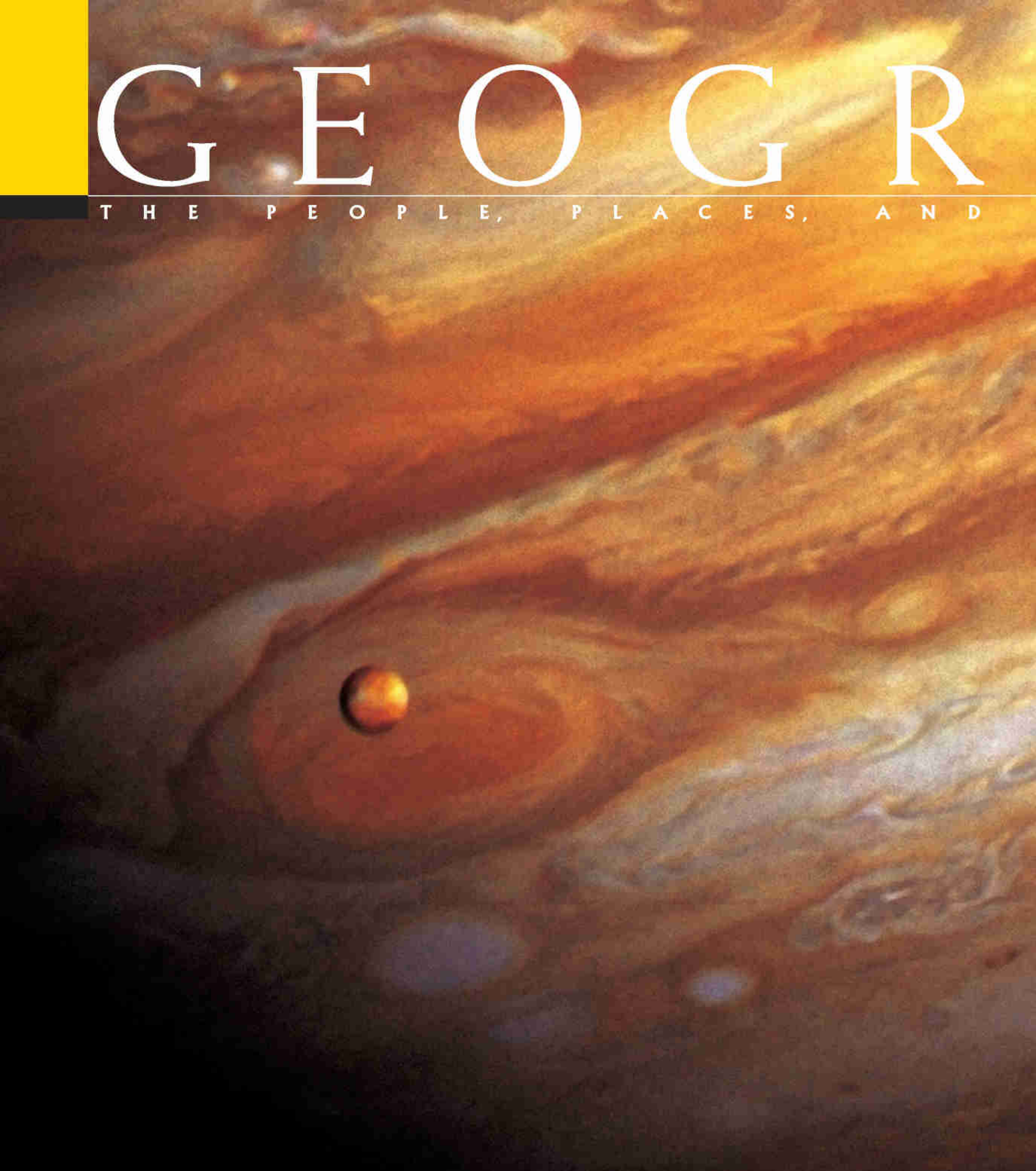
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Voyager 1 took this photograph of Jupiter and its moons Io, at left, and Europa when passing by in 1979, 18 months after its launch.

NASA/JPL

ASTRONOMY

Go Boldly, Voyager

Leaving the solar system, bound for interstellar space

The starship *Enterprise* it's not. Voyager 1 is a spidery contraption with less computer memory than some calculators and barely enough power to light three 100-watt bulbs. Yet this 1970s-vintage space probe will soon become humanity's first envoy to the stars.

Now hurtling at nearly 40,000 miles an hour well past the orbit of Pluto, Voyager has traveled farther than any other spacecraft. In late 2004 it passed a space boundary called the termination shock, a milestone near the outer limits of the solar system where the thin wind of particles blasted from the sun begins to collide with winds from interstellar space. In another ten years Voyager will leave the last vestiges of the solar wind and venture into the space between the stars. "Interstellar space, for the first time!" exults Eric Christian, Voyager's NASA program scientist.

For as long as NASA funds it and its decades-old technology holds out, Voyager will continue its epic journey of exploration. Launched in 1977, Voyager 1

Voyager 1

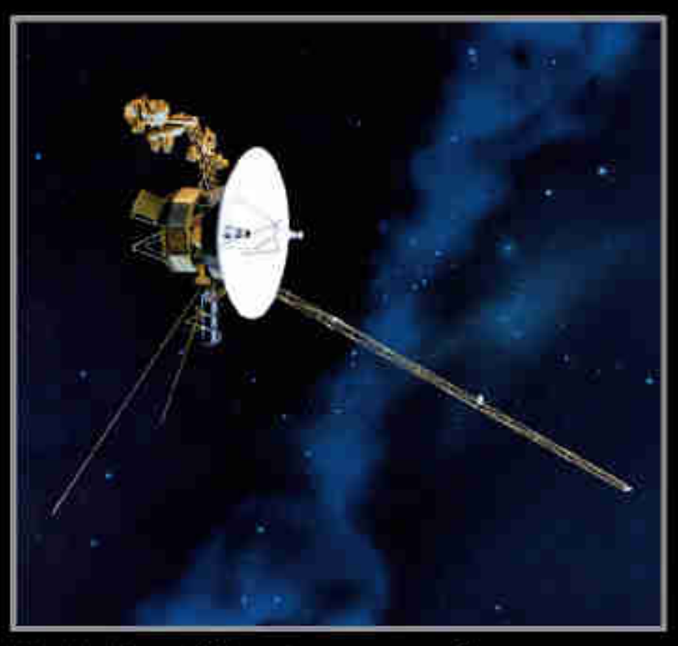
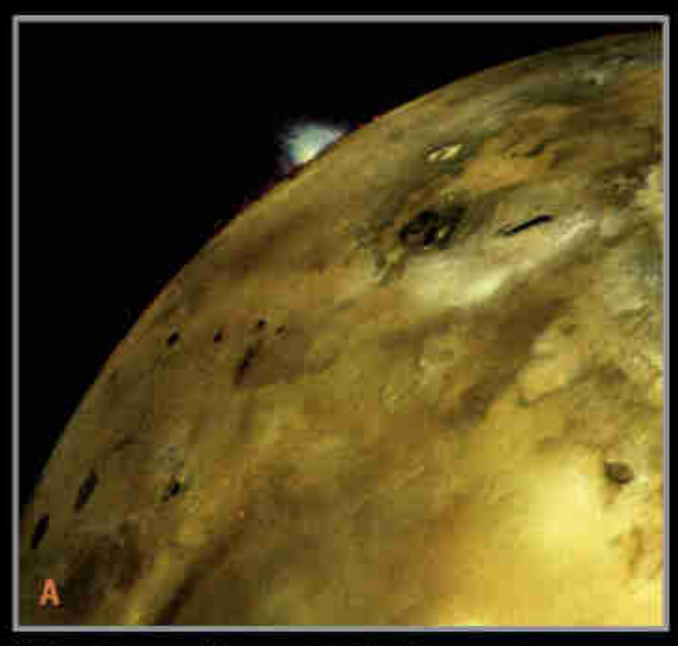
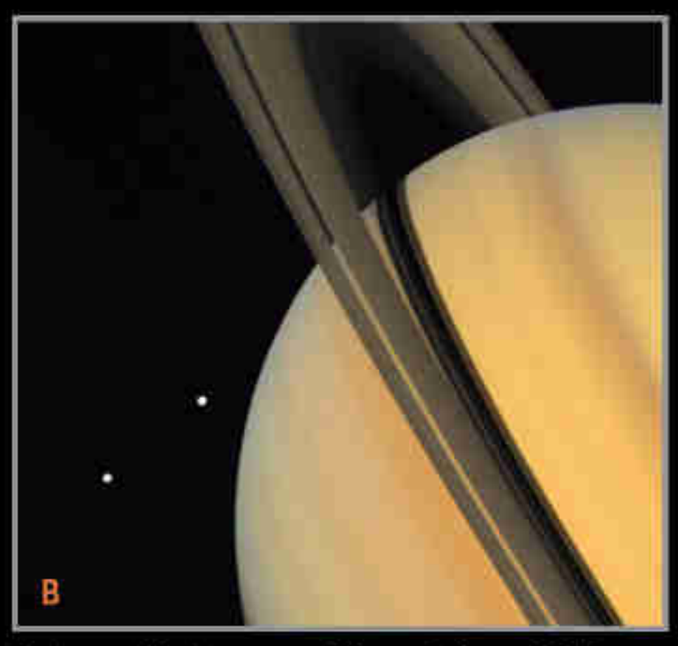


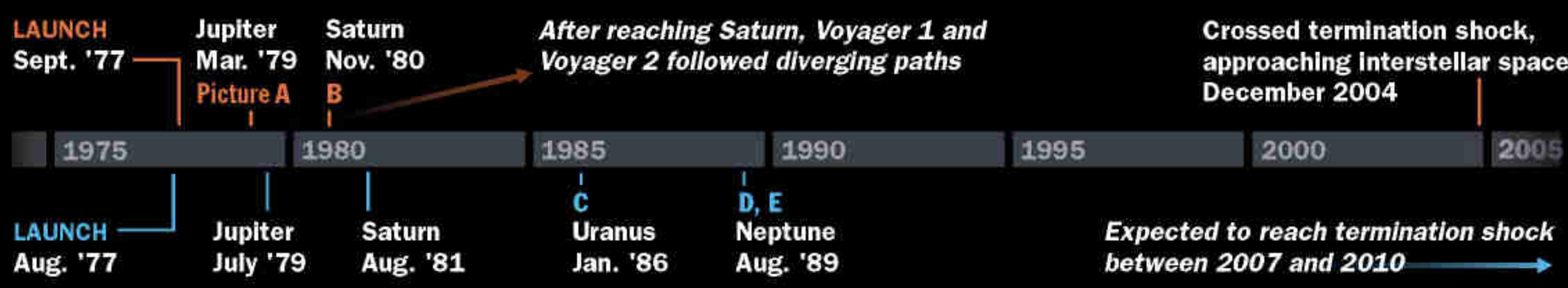
Illustration of Voyager spacecraft



Volcanic eruption on Jupiter's moon Io



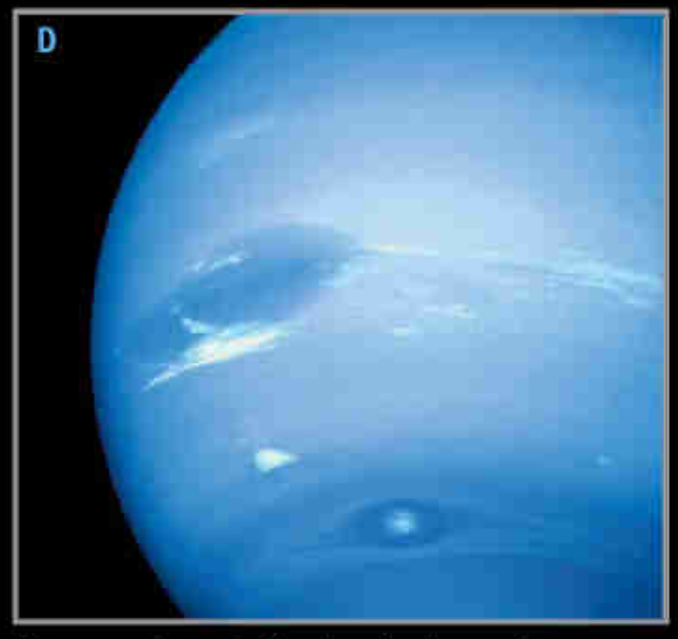
Saturn with its moons Dione, left, and Tethys



Voyager 2



Voyager's true-color view of distant Uranus



Storm systems in Neptune's atmosphere



Icy surface of Triton, Neptune's largest moon

and its companion, Voyager 2, made a 12-year tour of the outer solar system, visiting planets and moons all the way out to Uranus and Neptune—places never reached before or since. Along the way it transformed our view of the solar system. "Voyager really was the transition from the basic nine planets to an incredibly mixed plethora of worlds," says Louis Friedman, executive director of the Planetary Society.

The probes have revealed that Jupiter has faint rings, that Saturn's rings—more intricate than anyone imagined—are peppered with moonlets, and that 900-mph winds churn Neptune's atmosphere. The moons of the outer planets had long been expected to be pitted and dead like our own, but Voyager found they were a study in diversity: seething with volcanic activity, swathed in hydrocarbon smog, crusted with ice floating atop what may be a hidden ocean. Says one scientist: "NASA in the 20th century is going to be remembered for two things: Apollo moon landings and Voyager."

Yet Voyager started out as a compromise. It was conceived in the early 1970s after NASA abandoned its plans to take advantage of a rare alignment of planets by sending a costly fleet of four spacecraft on a "grand tour" from Jupiter out to Pluto. The two Voyagers were designed to go no farther than Saturn.

"Of course, we all had our hopes that the mission could go on," says Ed Stone, the Voyager chief scientist since 1972. He and

NASA/JPL (ALL)

STAND IN AWE? YES.

FOLLOW IN FOOTSTEPS?

NOT RECOMMENDED.

Ed Viesturs was hailed by National Geographic as one of the strongest high-altitude mountaineers on Earth. He has gazed from the summit of Mount Everest six times, and climbed all 14 of the world's 8,000-meter mountains, without supplemental oxygen; a feat few people will ever accomplish. There are exceptional explorers on this planet – but only one Ed Viesturs.



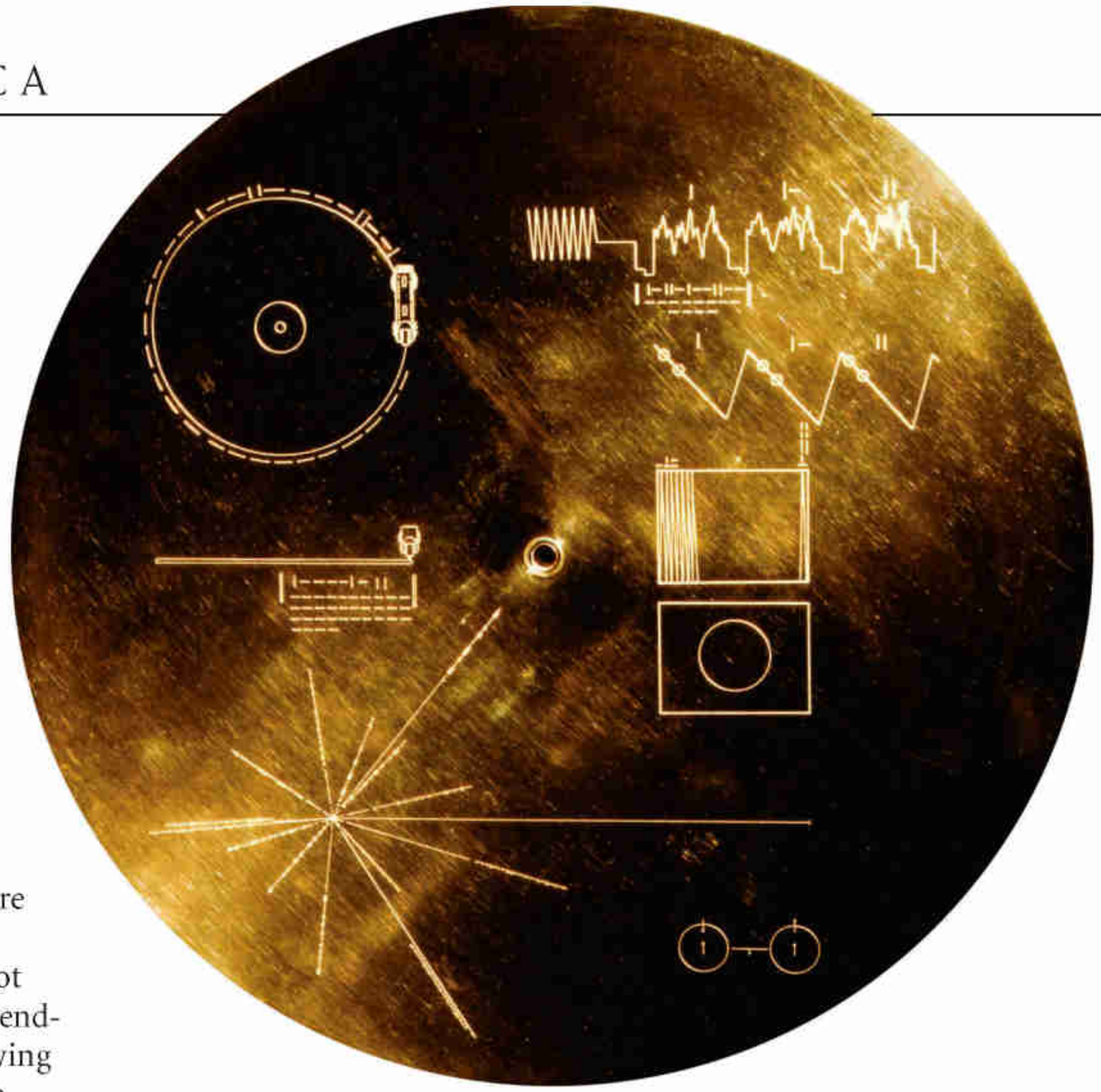
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Symbols on the cover of a 12-inch gold-plated copper record explain Voyager's origins—and how to play the disc.

his colleagues knew that if they sent a spacecraft careering past Saturn at just the right angle, Saturn's gravity would fling it straight toward Uranus and Neptune. After Voyager 1 explored Saturn and its moons, perhaps Voyager 2 could be vectored toward more distant planets.

Stone and his colleagues got their wish; in 1981 NASA extended the mission. In the following years Voyager 2 dazzled with close-ups of Uranus, Neptune, and their moons. Leaving Saturn, Voyager 1 climbed out of the plane of the planets and headed directly toward interstellar space.

As the decades passed, both Voyagers stayed healthy in spite of brutal cold and a barrage of cosmic rays. The spacecraft had been built to survive intense radiation near Jupiter. "In a sense radiation is a very rapid aging effect," says Stone. After Jupiter, he notes, the additional aging over 28 years didn't make much of a difference.

As the planets dwindled behind it, Voyager 1 had a quiet journey until mid-2002, when it detected bursts of particles apparently sprayed from a nearby shock wave. On December 16, 2004, it reached the source. A sudden strengthening of the solar wind's magnetism indicated that the wind had slowed and piled up—just what was expected at the termination shock. Voyager 2, on a slower route out of the solar system, is expected to reach the shock in as little as two years.

In another decade Voyager 1 should finally cross the heliopause, the last gasp of the solar wind, then sail out among the stars. With some 15 years left in its plutonium power source, it may still be alert and talkative. If cash-strapped NASA can keep finding 4.5 million dollars a year —a bargain compared with other missions—Voyager will give scientists on-the-spot reports from interstellar space.

It will be 40,000 years before Voyager 1 drifts past a neighboring star. For any aliens they might meet, both Voyagers bear a gift: a disc storing images and sounds from Earth. The technology, however, falls short of *Star Trek* standards. Each disc is designed to be played on a turntable, and a phonograph needle is thoughtfully included. —*Tim Appenzeller*



First published in a May 1977 GEOGRAPHIC story on Malaysia, this photograph was included on the Voyager golden records.

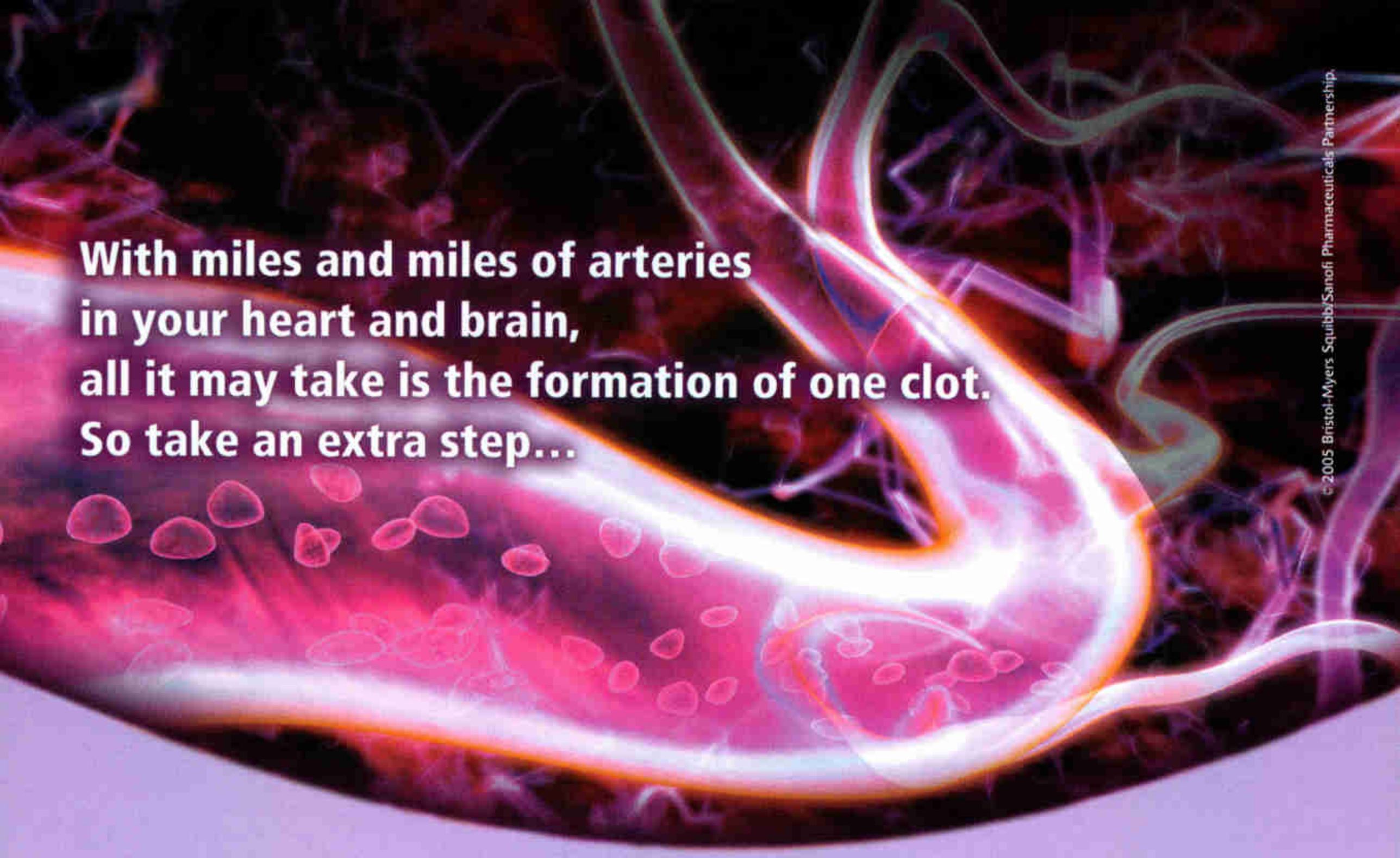
On the golden record

Sounds and images include **Scenes of Earth** showing people (left), places, animals, technology. **Sounds of Earth** re-creating noises such as a rocket liftoff, surf, rain, and music—from Pygmy initiation-rite songs to Chuck Berry's rock-and-roll. **Greetings** in 55 languages.

WHAT'S OUT THERE?

Discover the universe with an interactive quiz and view images from space at **ngm.com/space.**

NASA/JPL (TOP); DAVID ALAN HARVEY



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...if you've been hospitalized for heart-related chest pain or a certain type of heart attack.

Doctors call these conditions ACS, or Acute Coronary Syndrome. You can do more to help protect yourself against a future heart attack or stroke – ask your doctor about adding PLAVIX.



For most, heart attack or stroke is caused when platelets form clots that block the flow of blood to the heart or brain.

Think aspirin and other heart medications alone are enough? Adding PLAVIX could help protect you against a future heart attack or stroke.



PLAVIX, added to aspirin and your current treatment, helps raise your protection against a future heart attack or stroke.

Prescription PLAVIX and your other medications work in different ways. Adding PLAVIX can go beyond your current treatment. PLAVIX, taken with aspirin, plays its own role in keeping platelets from sticking together and forming clots – which helps keep blood flowing.

Talk to your doctor about PLAVIX.
For more information, visit www.plavix.com
Or call 1-800-470-4094.

If you need help paying for prescription medicines, you may be eligible for assistance. Call 1-888-4PPA-NOW (1-888-477-2669), or go to www.pparx.org.

Partnership for Prescription Assistance

ONCE-A-DAY

Plavix®
(clopidogrel bisulfate) 75mg tablets

Add more protection against heart attack or stroke

IMPORTANT INFORMATION: If you have a stomach ulcer or other condition that causes bleeding, you shouldn't use PLAVIX. When taking PLAVIX alone or with some medicines including aspirin, the risk of bleeding may increase. To minimize this risk, talk to your doctor before taking aspirin or other medicines with PLAVIX. Additional rare but serious side effects could occur.

Please see important product information on the following page.

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PLAVIX®

Rx only

clopidogrel bisulfate tablets

Brief Summary of Prescribing Information Rev. May 2005

INDICATIONS AND USAGE

PLAVIX (clopidogrel bisulfate) is indicated for the reduction of atherothrombotic events as follows:

- **Recent MI, Recent Stroke or Established Peripheral Arterial Disease**
 For patients with a history of recent myocardial infarction (MI), recent stroke, or established peripheral arterial disease, PLAVIX has been shown to reduce the rate of a combined endpoint of new ischemic stroke (fatal or not), new MI (fatal or not), and other vascular death.
- **Acute Coronary Syndrome**
 For patients with acute coronary syndrome (unstable angina/non-Q-wave MI) including patients who are to be managed medically and those who are to be managed with percutaneous coronary intervention (with or without stent) or CABG, PLAVIX has been shown to decrease the rate of a combined endpoint of cardiovascular death, MI, or stroke as well as the rate of a combined endpoint of cardiovascular death, MI, stroke, or refractory ischemia.

CONTRAINDICATIONS

The use of PLAVIX is contraindicated in the following conditions:

- Hypersensitivity to the drug substance or any component of the product.
- Active pathological bleeding such as peptic ulcer or intracranial hemorrhage.

WARNINGS

Thrombotic thrombocytopenic purpura (TTP): TTP has been reported rarely following use of PLAVIX, sometimes after a short exposure (<2 weeks). TTP is a serious condition and requires urgent referral to a hematologist for prompt treatment. It is characterized by thrombocytopenia, microangiopathic hemolytic anemia (schistocytes [fragmented RBCs] seen on peripheral smear), neurological findings, renal dysfunction, and fever. TTP was not seen during clopidogrel's clinical trials, which included over 17,500 clopidogrel-treated patients. In world-wide postmarketing experience, however, TTP has been reported at a rate of about four cases per million patients exposed, or about 11 cases per million patient-years. The background rate is thought to be about four cases per million person-years. (See **ADVERSE REACTIONS**.)

PRECAUTIONS

General

PLAVIX prolongs the bleeding time and therefore should be used with caution in patients who may be at risk of increased bleeding from trauma, surgery, or other pathological conditions (particularly gastrointestinal and intraocular). If a patient is to undergo elective surgery and an antiplatelet effect is not desired, PLAVIX should be discontinued 5 days prior to surgery.

Due to the risk of bleeding and undesirable hematological effects, blood cell count determination and/or other appropriate testing should be promptly considered, whenever such suspected clinical symptoms arise during the course of treatment (see **ADVERSE REACTIONS**).

In patients with recent TIA or stroke who are at high risk for recurrent ischemic events, the combination of aspirin and PLAVIX has not been shown to be more effective than PLAVIX alone, but the combination has been shown to increase major bleeding.

GI Bleeding: In CAPRIE, PLAVIX was associated with a rate of gastrointestinal bleeding of 2.0%, vs. 2.7% on aspirin. In CURE, the incidence of major gastrointestinal bleeding was 1.3% vs 0.7% (PLAVIX + aspirin vs. placebo + aspirin, respectively). PLAVIX should be used with caution in patients who have lesions with a propensity to bleed (such as ulcers). Drugs that might induce such lesions should be used with caution in patients taking PLAVIX.

Use in Hepatically Impaired Patients: Experience is limited in patients with severe hepatic disease, who may have bleeding diatheses. PLAVIX should be used with caution in this population.

Use in Renally-impaired Patients: Experience is limited in patients with severe renal impairment. PLAVIX should be used with caution in this population.

Information for Patients

Patients should be told that they may bleed more easily and it may take them longer than usual to stop bleeding when they take PLAVIX or PLAVIX combined with aspirin, and that they should report any unusual bleeding to their physician. Patients should inform physicians and dentists that they are taking PLAVIX and/or any other product known to affect bleeding before any surgery is scheduled and before any new drug is taken.

Drug Interactions

Study of specific drug interactions yielded the following results:

Aspirin: Aspirin did not modify the clopidogrel-mediated inhibition of ADP-induced platelet aggregation. Concomitant administration of 500 mg of aspirin twice a day for 1 day did not significantly increase the prolongation of bleeding time induced by PLAVIX. PLAVIX potentiated the effect of aspirin on collagen-induced platelet aggregation. PLAVIX and aspirin have been administered together for up to one year.

Heparin: In a study in healthy volunteers, PLAVIX did not necessitate modification of the heparin dose or alter the effect of heparin on coagulation. Coadministration of heparin had no effect on inhibition of platelet aggregation induced by PLAVIX.

Nonsteroidal Anti-Inflammatory Drugs (NSAIDs): In healthy volunteers receiving naproxen, concomitant administration of PLAVIX was associated with increased occult gastrointestinal blood loss. NSAIDs and PLAVIX should be coadministered with caution.

Warfarin: Because of the increased risk of bleeding, the concomitant administration of warfarin with PLAVIX should be undertaken with caution. (See **PRECAUTIONS– General**.)

Other Concomitant Therapy: No clinically significant pharmacodynamic interactions were observed when PLAVIX was coadministered with **atenolol, nifedipine,** or both atenolol and nifedipine. The pharmacodynamic activity of PLAVIX was also not significantly influenced by the coadministration of **phenobarbital, cimetidine** or **estrogen**.

The pharmacokinetics of **digoxin** or **theophylline** were not modified by the coadministration of PLAVIX (clopidogrel bisulfate).

At high concentrations *in vitro*, clopidogrel inhibits P_{450} (2C9). Accordingly, PLAVIX may interfere with the metabolism of **phenytoin, tamoxifen, tolbutamide, warfarin, torsemide, fluvastatin,** and many **non-steroidal anti-inflammatory agents,** but there are no data with which to predict the magnitude of these interactions. Caution should be used when any of these drugs is coadministered with PLAVIX.

In addition to the above specific interaction studies, patients entered into clinical trials with PLAVIX received a variety of concomitant medications including **diuretics, beta-blocking agents, angiotensin converting enzyme inhibitors, calcium antagonists, cholesterol lowering agents, coronary vasodilators, antidiabetic agents** (including **insulin**), **antiepileptic agents, hormone replacement therapy, heparins** (unfractionated and LMWH) and **GPIIb/IIIa antagonists** without evidence of clinically significant adverse interactions. The use of oral anticoagulants, non-study antiplatelet drug and chronic NSAIDs was not allowed in CURE and there are no data on their concomitant use with clopidogrel.

Drug/Laboratory Test Interactions

None known.

Carcinogenesis, Mutagenesis, Impairment of Fertility

There was no evidence of tumorigenicity when clopidogrel was administered for 78 weeks to mice and 104 weeks to rats at dosages up to 77 mg/kg per day, which afforded plasma exposures >25 times that in humans at the recommended daily dose of 75 mg.

Clopidogrel was not genotoxic in four *in vitro* tests (Ames test, DNA-repair test in rat hepatocytes, gene mutation assay in Chinese hamster fibroblasts, and metaphase chromosome analysis of human lymphocytes) and in one *in vivo* test (micronucleus test by oral route in mice).

Clopidogrel was found to have no effect on fertility of male and female rats at oral doses up to 400 mg/kg per day (52 times the recommended human dose on a mg/m² basis).

Pregnancy

Pregnancy Category B. Reproduction studies performed in rats and rabbits at doses up to 500 and 300 mg/kg/day (respectively, 65 and 78 times the recommended daily human dose on a mg/m² basis), revealed no evidence of impaired fertility or fetotoxicity due to clopidogrel. There are, however, no adequate and well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of a human response, PLAVIX should be used during pregnancy only if clearly needed.

Nursing Mothers

Studies in rats have shown that clopidogrel and/or its metabolites are excreted in the milk. It is not known whether this drug is excreted in human milk. Because many drugs are excreted in human milk and because of the potential for serious adverse reactions in nursing infants, a decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the nursing woman.

Pediatric Use

Safety and effectiveness in the pediatric population have not been established.

Geriatric Use

Of the total number of subjects in controlled clinical studies, approximately 50% of patients treated with PLAVIX were 65 years of age and over. Approximately 16% of patients treated with PLAVIX were 75 years of age and over.

The observed difference in risk of thrombotic events with clopidogrel plus aspirin versus placebo plus aspirin by age category is provided in Figure 3 (see **CLINICAL STUDIES**). The observed difference in risk of bleeding events with clopidogrel plus aspirin versus placebo plus aspirin by age category is provided in Table 3 (see **ADVERSE REACTIONS**).

ADVERSE REACTIONS

PLAVIX has been evaluated for safety in more than 17,500 patients, including over 9,000 patients treated for 1 year or more. The overall tolerability of PLAVIX in CAPRIE was similar to that of aspirin regardless of age, gender and race, with an approximately equal incidence (13%) of patients withdrawing from treatment because of adverse reactions. The clinically important adverse events observed in CAPRIE and CURE are discussed below.

Hemorrhagic: In CAPRIE patients receiving PLAVIX, gastrointestinal hemorrhage occurred at a rate of 2.0%, and required hospitalization in 0.7%. In patients receiving aspirin, the corresponding rates were 2.7% and 1.1%, respectively. The incidence of intracranial hemorrhage was 0.4% for PLAVIX compared to 0.5% for aspirin.

In CURE, PLAVIX use with aspirin was associated with an increase in bleeding compared to placebo with aspirin (see Table 3). There was an excess in major bleeding in patients receiving PLAVIX plus aspirin compared with placebo plus aspirin, primarily gastrointestinal and at puncture sites. The incidence of intracranial hemorrhage (0.1%), and fatal bleeding (0.2%), were the same in both groups.

The overall incidence of bleeding is described in Table 3 for patients receiving both PLAVIX and aspirin in CURE,

Table 3: CURE Incidence of bleeding complications (% patients)

Event	PLAVIX (+ aspirin)* (n=6259)	Placebo (+ aspirin)* (n=6303)	P-value
Major bleeding †	3.7 ‡	2.7 §	0.001
Life-threatening bleeding	2.2	1.8	0.13
Fatal	0.2	0.2	
5 g/dL hemoglobin drop	0.9	0.9	
Requiring surgical intervention	0.7	0.7	
Hemorrhagic strokes	0.1	0.1	
Requiring inotropes	0.5	0.5	
Requiring transfusion (≥4 units)	1.2	1.0	
Other major bleeding	1.6	1.0	0.005
Significantly disabling	0.4	0.3	
Intraocular bleeding with significant loss of vision	0.05	0.03	
Requiring 2-3 units of blood	1.3	0.9	
Minor bleeding ¶	5.1	2.4	<0.001

* Other standard therapies were used as appropriate.

† Life threatening and other major bleeding.

‡ Major bleeding event rate for PLAVIX + aspirin was dose-dependent on aspirin: <100 mg=2.6%; 100-200 mg= 3.5%; >200 mg=4.9%
Major bleeding event rates for PLAVIX + aspirin by age were: <65 years = 2.5%, ≥65 to <75 years = 4.1%, ≥75 years 5.9%

§ Major bleeding event rate for placebo + aspirin was dose-dependent on aspirin: <100 mg=2.0%; 100-200 mg= 2.3%; >200 mg=4.0%
Major bleeding event rates for placebo + aspirin by age were: <65 years = 2.1%, ≥65 to <75 years = 3.1%, ≥75 years 3.6%

¶ Led to interruption of study medication.

Ninety-two percent (92%) of the patients in the CURE study received heparin/LMWH, and the rate of bleeding in these patients was similar to the overall results.

There was no excess in major bleeds within seven days after coronary bypass graft surgery in patients who stopped therapy more than five days prior to surgery (event rate 4.4% PLAVIX + aspirin; 5.3% placebo + aspirin). In patients who remained on therapy within five days of bypass graft surgery, the event rate was 9.6% for PLAVIX + aspirin, and 6.3% for placebo + aspirin.

Neutropenia/agranulocytosis: Ticlopidine, a drug chemically similar to PLAVIX, is associated with a 0.8% rate of severe neutropenia (less than 450 neutrophils/μL). In CAPRIE severe neutropenia was observed in six patients, four on PLAVIX and two on aspirin. Two of the 9599 patients who received PLAVIX and none of the 9586 patients who received aspirin had neutrophil counts of zero. One of the four PLAVIX patients in CAPRIE was receiving cytotoxic chemotherapy, and another recovered and returned to the trial after only temporarily interrupting treatment with PLAVIX (clopidogrel bisulfate). In CURE, the numbers of patients with thrombocytopenia (19 PLAVIX + aspirin vs. 24 placebo + aspirin) or neutropenia (3 vs. 3) were similar.

Although the risk of myelotoxicity with PLAVIX (clopidogrel bisulfate) thus appears to be quite low, this possibility should be considered when a patient receiving PLAVIX demonstrates fever or other sign of infection.

Gastrointestinal: Overall, the incidence of gastrointestinal events (e.g. abdominal pain, dyspepsia, gastritis and constipation) in patients receiving PLAVIX (clopidogrel bisulfate) was 27.1%, compared to 29.8% in those receiving aspirin in the CAPRIE trial. In the CURE trial the incidence of these gastrointestinal events for patients receiving PLAVIX + aspirin was 11.7% compared to 12.5% for those receiving placebo + aspirin.

In the CAPRIE trial, the incidence of peptic, gastric or duodenal ulcers was 0.7% for PLAVIX (clopidogrel bisulfate) and 1.2% for aspirin. In the CURE trial the incidence of peptic, gastric or duodenal ulcers was 0.4% for PLAVIX + aspirin and 0.3% for placebo + aspirin.

Cases of diarrhea were reported in the CAPRIE trial in 4.5% of patients in the PLAVIX group compared to 3.4% in the aspirin group. However, these were rarely severe (PLAVIX=0.2% and aspirin=0.1%). In the CURE trial, the incidence of diarrhea for patients receiving PLAVIX + aspirin was 2.1% compared to 2.2% for those receiving placebo + aspirin.

In the CAPRIE trial, the incidence of patients withdrawing from treatment because of gastrointestinal adverse reactions was 3.2% for PLAVIX and 4.0% for aspirin. In the CURE trial, the incidence of patients withdrawing from treatment because of gastrointestinal adverse reactions was 0.9% for PLAVIX + aspirin compared with 0.8% for placebo + aspirin.

Rash and Other Skin Disorders: In the CAPRIE trial, the incidence of skin and appendage disorders in patients receiving PLAVIX was 15.8% (0.7% serious); the corresponding rate in aspirin patients was 13.1% (0.5% serious). In the CURE trial the incidence of rash or other skin disorders in patients receiving PLAVIX + aspirin was 4.0% compared to 3.5% for those receiving placebo + aspirin.

In the CAPRIE trial, the overall incidence of patients withdrawing from treatment because of skin and appendage disorders adverse reactions was 1.5% for PLAVIX and 0.8% for aspirin. In the CURE trial, the incidence of patients withdrawing because of skin and appendage disorders adverse reactions was 0.7% for PLAVIX + aspirin compared with 0.3% for placebo + aspirin.

Adverse events occurring in ≥2.5% of patients on PLAVIX in the CAPRIE controlled clinical trial are shown below regardless of relationship to PLAVIX. The median duration of therapy was 20 months, with a maximum of 3 years.

Table 4: Adverse Events Occurring in ≥ 2.5% of PLAVIX Patients in CAPRIE

Body System **Event**	**% Incidence (% Discontinuation)** **PLAVIX [n=9599]**	**Aspirin [n=9586]**
Body as a Whole – general disorders		
Chest Pain	8.3 (0.2)	8.3 (0.3)
Accidental/Inflicted Injury	7.9 (0.1)	7.3 (0.1)
Influenza-like symptoms	7.5 (<0.1)	7.0 (<0.1)
Pain	6.4 (0.1)	6.3 (0.1)
Fatigue	3.3 (0.1)	3.4 (0.1)
Cardiovascular disorders, general		
Edema	4.1 (<0.1)	4.5 (<0.1)
Hypertension	4.3 (<0.1)	5.1 (<0.1)
Central & peripheral nervous system disorders		
Headache	7.6 (0.3)	7.2 (0.2)
Dizziness	6.2 (0.2)	6.7 (0.3)
Gastrointestinal system disorders		
Abdominal pain	5.6 (0.7)	7.1 (1.0)
Dyspepsia	5.2 (0.6)	6.1 (0.7)
Diarrhea	4.5 (0.4)	3.4 (0.3)
Nausea	3.4 (0.5)	3.8 (0.4)
Metabolic & nutritional disorders		
Hypercholesterolemia	4.0 (0)	4.4 (<0.1)
Musculo-skeletal system disorders		
Arthralgia	6.3 (0.1)	6.2 (0.1)
Back Pain	5.8 (0.1)	5.3 (<0.1)
Platelet, bleeding, & clotting disorders		
Purpura/Bruise	5.3 (0.3)	3.7 (0.1)
Epistaxis	2.9 (0.2)	2.5 (0.1)
Psychiatric disorders		
Depression	3.6 (0.1)	3.9 (0.2)
Respiratory system disorders		
Upper resp tract infection	8.7 (<0.1)	8.3 (<0.1)
Dyspnea	4.5 (0.1)	4.7 (0.1)
Rhinitis	4.2 (0.1)	4.2 (<0.1)
Bronchitis	3.7 (0.1)	3.7 (0)
Coughing	3.1 (<0.1)	2.7(<0.1)
Skin & appendage disorders		
Rash	4.2 (0.5)	3.5 (0.2)
Pruritus	3.3 (0.3)	1.6 (0.1)
Urinary system disorders		
Urinary tract infection	3.1 (0)	3.5 (0.1)

Incidence of discontinuation, regardless of relationship to therapy, is shown in parentheses.

Adverse events occurring in ≥2.0% of patients on PLAVIX in the CURE controlled clinical trial are shown below regardless of relationship to PLAVIX.

Table 5: Adverse Events Occurring in ≥ 2.0% of PLAVIX Patients in CURE

Body System **Event**	**% Incidence (% Discontinuation)** **PLAVIX (+ aspirin)* [n=6259]**	**Placebo (+ aspirin)* [n=6303]**
Body as a Whole– general disorders		
Chest Pain	2.7 (<0.1)	2.8 (0.0)
Central & peripheral nervous system disorders		
Headache	3.1 (0.1)	3.2 (0.1)
Dizziness	2.4 (0.1)	2.0 (<0.1)
Gastrointestinal system disorders		
Abdominal pain	2.3 (0.3)	2.8 (0.3)
Dyspepsia	2.0 (0.1)	1.9 (<0.1)
Diarrhea	2.1 (0.1)	2.2 (0.1)

*Other standard therapies were used as appropriate.

Other adverse experiences of potential importance occurring in 1% to 2.5% of patients receiving PLAVIX (clopidogrel bisulfate) in the CAPRIE or CURE controlled clinical trials are listed below regardless of relationship to PLAVIX. In general, the incidence of these events was similar to that in patients receiving aspirin (in CAPRIE) or placebo + aspirin (in CURE).

Autonomic Nervous System Disorders: Syncope, Palpitation. *Body as a Whole-general disorders:* Asthenia, Fever, Hernia. *Cardiovascular disorders:* Cardiac failure. *Central and peripheral nervous system disorders:* Cramps legs, Hypoaesthesia, Neuralgia, Paraesthesia, Vertigo. *Gastrointestinal system disorders:* Constipation, Vomiting. *Heart rate and rhythm disorders:* Fibrillation atrial. *Liver and biliary system disorders:* Hepatic enzymes increased. *Metabolic and nutritional disorders:* Gout, hyperuricemia, non-protein nitrogen (NPN) increased. *Musculo-skeletal system disorders:* Arthritis, Arthrosis. *Platelet, bleeding & clotting disorders:* GI hemorrhage, hematoma, platelets decreased. *Psychiatric disorders:* Anxiety, Insomnia. *Red blood cell disorders:* Anemia. *Respiratory system disorders:* Pneumonia, Sinusitis. *Skin and appendage disorders:* Eczema, Skin ulceration. *Urinary system disorders:* Cystitis. *Vision disorders:* Cataract, Conjunctivitis.

Other potentially serious adverse events which may be of clinical interest but were rarely reported (<1%) in patients who received PLAVIX in the CAPRIE or CURE controlled clinical trials are listed below regardless of relationship to PLAVIX. In general, the incidence of these events was similar to that in patients receiving aspirin (in CAPRIE) or placebo + aspirin (in CURE).

Body as a whole: Allergic reaction, necrosis ischemic. *Cardiovascular disorders:* Edema generalized. *Gastrointestinal system disorders:* Gastric ulcer perforated, gastritis hemorrhagic, upper GI ulcer hemorrhagic. *Liver and Biliary system disorders:* Bilirubinemia, hepatitis infectious, liver fatty. *Platelet, bleeding and clotting disorders:* hemarthrosis, hematuria, hemoptysis, hemorrhage intracranial, hemorrhage retroperitoneal, hemorrhage of operative wound, ocular hemorrhage, pulmonary hemorrhage, purpura allergic, thrombocytopenia. *Red blood cell disorders:* Anemia aplastic, anemia hypochromic. *Reproductive disorders, female:* Menorrhagia. *Respiratory system disorders:* Hemothorax. *Skin and appendage disorders:* Bullous eruption, rash erythematous, rash maculopapular, urticaria. *Urinary system disorders:* Abnormal renal function, acute renal failure. *White cell and reticuloendothelial system disorders:* Agranulocytosis, granulocytopenia, leukemia, leukopenia, neutrophils decreased.

Postmarketing Experience

The following events have been reported spontaneously from worldwide postmarketing experience:

- *Body as a whole:*
 -hypersensitivity reactions, anaphylactoid reactions, serum sickness
- *Central and Peripheral Nervous System disorders:*
 -confusion, hallucinations, taste disorders
- *Hepato-biliary disorders:*
 -abnormal liver function test, hepatitis (non-infectious), acute liver failure
- *Platelet, Bleeding and Clotting disorders:*
 -cases of bleeding with fatal outcome (especially intracranial, gastrointestinal and retroperitoneal hemorrhage)
 -agranulocytosis, aplastic anemia/pancytopenia, thrombotic thrombocytopenic purpura (TTP) – some cases with fatal outcome- (see **WARNINGS**).
 -conjunctival, ocular and retinal bleeding
- *Respiratory, thoracic and mediastinal disorders:*
 -bronchospasm, interstitial pneumonitis
- *Skin and subcutaneous tissue disorders:*
 -angioedema, erythema multiforme, Stevens-Johnson syndrome, toxic epidermal necrolysis, lichen planus
- *Renal and urinary disorders:*
 - glomerulopathy, increased creatinine levels
- *Vascular disorders:*
 - vasculitis, hypotension
- *Gastrointestinal disorders:*
 - colitis (including ulcerative or lymphocytic colitis), pancreatitis, stomatitis
- *Musculoskeletal, connective tissue and bone disorders:*
 - myalgia

OVERDOSAGE

Overdose following clopidogrel administration may lead to prolonged bleeding time and subsequent bleeding complications. A single oral dose of clopidogrel at 1500 or 2000 mg/kg was lethal to mice and to rats and at 3000 mg/kg to baboons. Symptoms of acute toxicity were vomiting (in baboons), prostration, difficult breathing, and gastrointestinal hemorrhage in all species.

Recommendations About Specific Treatment:

Based on biological plausibility, platelet transfusion may be appropriate to reverse the pharmacological effects of PLAVIX if quick reversal is required.

DOSAGE AND ADMINISTRATION

Recent MI, Recent Stroke, or Established Peripheral Arterial Disease

The recommended daily dose of PLAVIX is 75 mg once daily.

Acute Coronary Syndrome

For patients with acute coronary syndrome (unstable angina/non-Q-wave MI), PLAVIX should be initiated with a single 300 mg loading dose and then continued at 75 mg once daily. Aspirin (75 mg-325 mg once daily) should be initiated and continued in combination with PLAVIX. In CURE, most patients with Acute Coronary Syndrome also received heparin acutely (see **CLINICAL STUDIES**).

PLAVIX can be administered with or without food.

No dosage adjustment is necessary for elderly patients or patients with renal disease. (See **Clinical Pharmacology: Special Populations**.)

Distributed by:
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Brief Summary of Prescribing Information May 2005

PLA-MAY05-B-Ae

TECHNOLOGY

Reconstructing a President

Scientists turn back the clock on Washington

Jeff Schwartz knows bones. As a physical anthropologist, he brings fossils to life. But when Schwartz signed on to help make the first historically accurate models of George Washington for Mount Vernon, the first President's home, he began empty-handed. Out of respect for the founding father, his bones were left interred.



So Schwartz worked in reverse. To determine Washington's bone structure, he used surviving clothing and portraits like the one above, as well as laser scans of a bust, a life mask, and several sets of dentures. The team's computer-modeling experts then created a three-dimensional figure of Washington as he likely looked at 57, his age when he became President.

From there Schwartz worked with historians to shave off years, taking into account details like the corsets 18th-century children wore that sloped their shoulders. He also focused on the jawline. At 19 Washington had all of his teeth. By 57 his jaw had softened after losing all but one. And his dentures, made of human teeth (not wood), hurt and fit so poorly that he often kept his mouth shut just to keep them in. "He appears standoffish," says Schwartz. "But anyone would with that much dental pain."

—Whitney Dangerfield



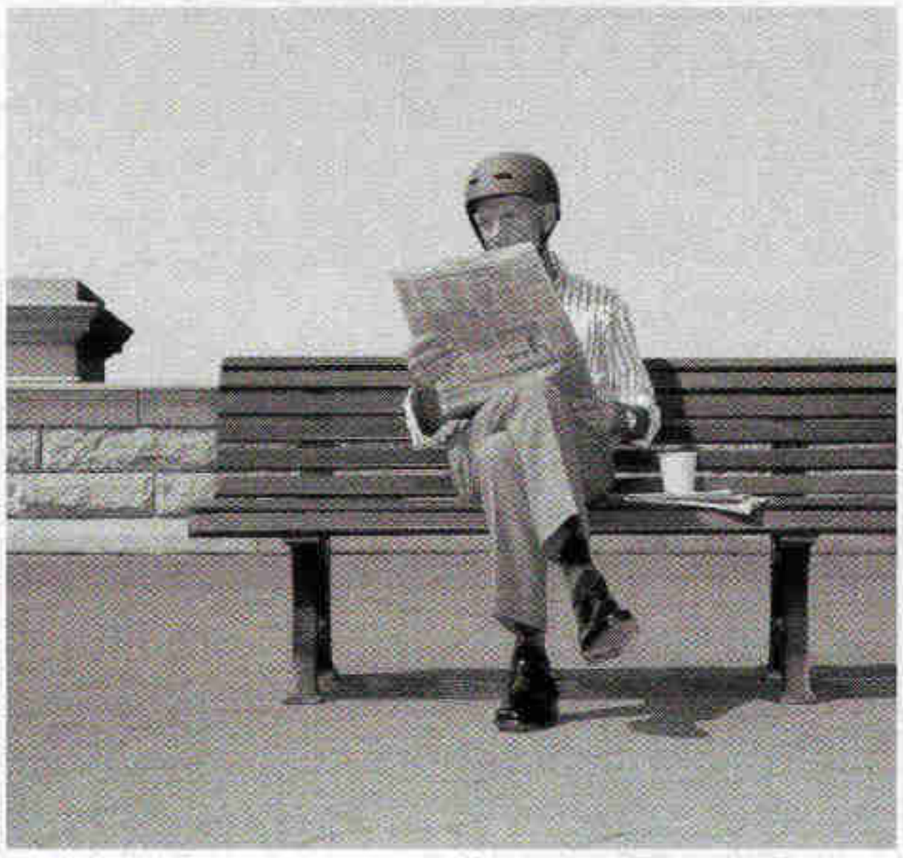




George Washington at age 19, when he was a land surveyor in Ohio; at 45, as a battle-hardened Revolutionary War general; and at 57, as the newly inaugurated first President of the United States. The three models—with clothes and hair—will go on display in October at the President's former Virginia estate, Mount Vernon.

ALL IMAGES COURTESY MOUNT VERNON LADIES' ASSOCIATION;
MODELS BY JEFFREY H. SCHWARTZ AND PARTNERSHIP FOR RESEARCH IN SPATIAL MODELING

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During training in Montana, biologist Alice Whitelaw rewards Camas, a detection dog.

CONSERVATION

They're Sniffing for Science

Detection dogs help the study of threatened species

The German shepherd trots off, nose down in the grass of Kenya's Laikipia Plateau. "OK, Oakley," the dog's handler commands. "Find it!"

Oakley sniffs until he comes to a bush, then stops, sits, and looks up at his handler. She bends to retrieve the prize he has found: the scat—feces—of an endangered African wild dog. "Good dog!" she proclaims. The handler pulls a tennis ball from her pocket; Oakley leaps for his reward.

"He doesn't actually want the scat," says Aimee Hurt, a founding member of the U.S.-based group Working Dogs for Conservation. Hurt is in Kenya to train both Oakley and his handler. "He finds it so he can play with his ball. We're the ones who want the scat."

Detection dogs are sometimes taught to locate actual animals. Desert tortoises and black-footed ferrets have been studied with canine help. But more often the dogs learn to locate scat of creatures ranging from grizzly bears and wolves to bobcats and mountain lions.

What the dogs find provides conservationists with an array of data about a species: distribution, diet, and genetics. Scientists can use DNA gleaned from animal waste to identify individuals, kinship, sex, paternity, and population sizes—all without ever seeing the animal itself. "It can take years to gather this kind of information if you have to trap and radio-collar animals," Hurt explains.

Scat analysis might make a huge difference when wild species are accused of attacking domestic livestock, Hurt says. "A good detection dog will find the feces so we can see what the animal is actually eating." This may help reduce problems between people and wildlife. *—Virginia Morell*

CULTURE

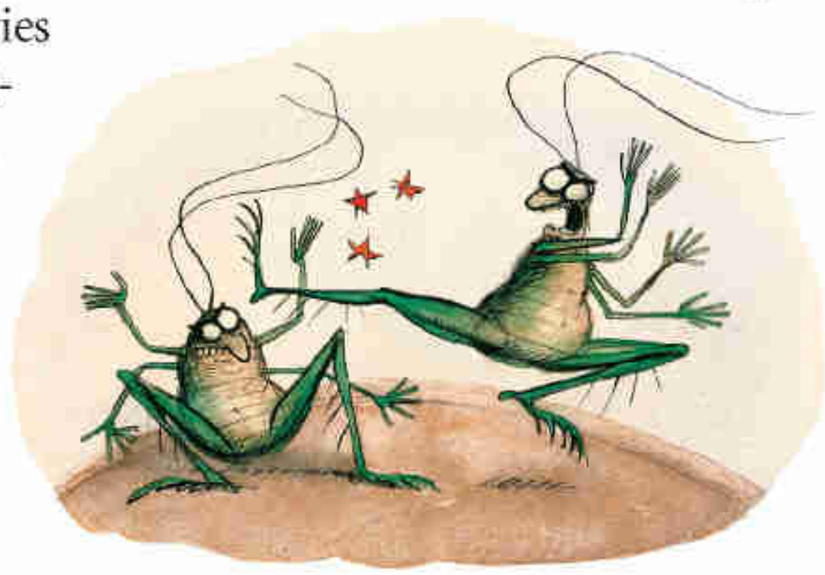
Cricket Match

Surrounded by shouting spectators, the two fierce combatants begin to tear each other limb from limb. The battle lasts only a few minutes; it ends with death. Cricket fighting, a Chinese blood sport that dates from the tenth century, is back in business, with illegal gambling rings often running the show.

Crickets were historically valued in China for their singing. By the 15th century cricket fighting became such a craze among emperors and their courts that peasants were required to deliver promising contenders to imperial officials. The popularity of cricket combat spread from the palace to the masses and thrived as a pastime until 1949, when the Chinese government banned the sport to try to stem gambling. But its die-hard fans never gave up. They took cricket fighting underground, where it maintained a small but fervent following.

Today the crowds have returned, and the sport's gone modern; some fighting crickets can sell for more than a thousand dollars. Another new twist: Shanghai police shut down one gambling den where the tiny gladiators had been dosed with performance-enhancing drugs.

—Cate Lineberry



GORDON WILTSIE (TOP); ART BY RICHARD THOMPSON

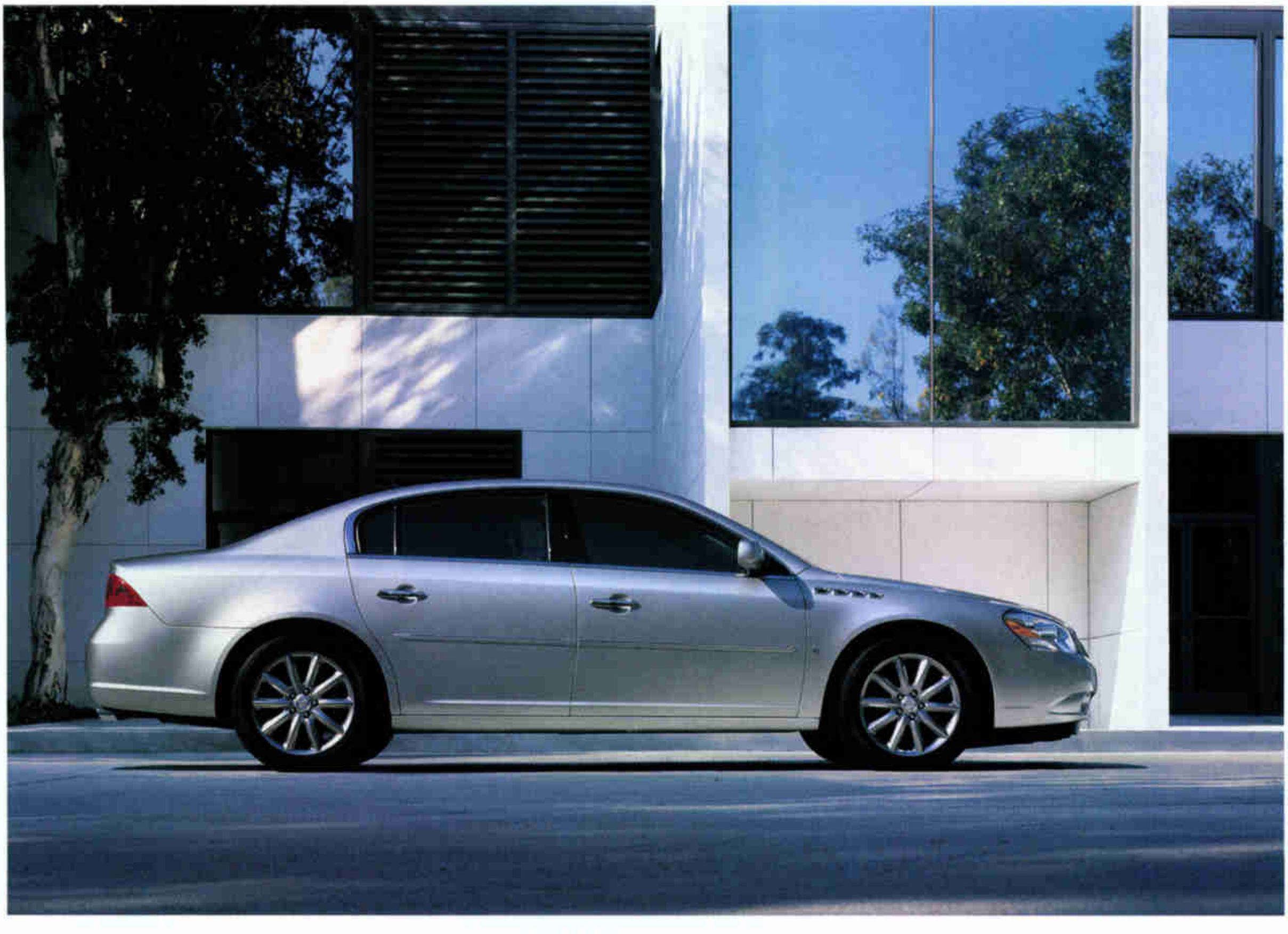
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ARCHAEOLOGY

Found: Oldest Maya Writing

Meaning of hieroglyphs remains a mystery

Digging deep inside a Maya pyramid at the Guatemalan site of San Bartolo, University of San Carlos archaeologist Boris Beltrán made a stunning discovery: Maya hieroglyphs so old that modern archaeologists can't read them. "We're looking at writing a good 500 years older than the standard script that we're familiar with," says Maya glyph expert David Stuart. The ten characters, painted on plaster, were discovered on rubble from a structure that had been demolished sometime prior to 200 B.C. So far Stuart recognizes just one sign (right, fourth from bottom), a version of *ajaw,* the symbol for king. "It's like seeing medieval calligraphy if you're only familiar with 20th-century handwriting," he says.

The son of Gene and George Stuart, former National Geographic editors who specialized in the Maya, Stuart spent much of his childhood among Maya ruins. "You have to be a linguist, an artist, and an archaeologist to do this work," he explains. What will it take to decipher these new glyphs? More of them, he says, so that code-breaking patterns can be identified. —*A. R. Williams*



Painted Maya glyphs—bold and clear as lettering from a felt-tip pen—are as old as any writing yet found in the Americas.

WEBSITE EXCLUSIVE Sights & Sounds of the Maya underworld are available at **ngm.com/0411/feature2.**

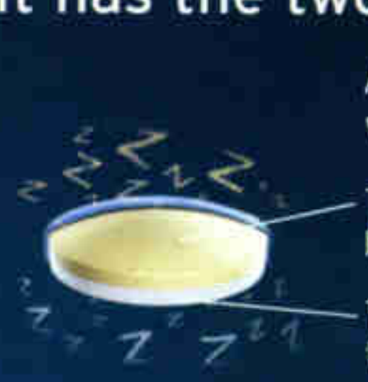
WILLIAM SATURNO, PROYECTO SAN BARTOLO



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††Individual results may vary.

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(zolpidem tartrate extended-release tablets)

INFORMATION FOR PATIENTS TAKING AMBIEN CR

Your doctor has prescribed Ambien CR to help you sleep. The following information is intended to guide you in the safe use of this medicine. It is not meant to take the place of your doctor's instructions. If you have any questions about Ambien CR tablets be sure to ask your doctor or pharmacist.

Ambien CR is used to treat different types of sleep problems, such as:

- trouble falling asleep
- waking up often during the night

Some people may have more than one of these problems.

Ambien CR belongs to a group of medicines known as the "sedative/hypnotics", or simply, sleep medicines. There are many different sleep medicines available to help people sleep better. Sleep problems are usually temporary, requiring treatment for only a short time, usually 1 or 2 days up to 1 or 2 weeks. Some people have chronic sleep problems that may require more prolonged use of sleep medicine. However, you should not use these medicines for long periods without talking with your doctor about the risks and benefits of prolonged use.

SIDE EFFECTS

Most common side effects:

- headache
- somnolence (sleepiness)
- dizziness

You may find that these medicines make you sleepy during the day. How drowsy you feel depends upon how your body reacts to the medicine, which sleep medicine you are taking, and how large a dose your doctor has prescribed. Daytime drowsiness is best avoided by taking the lowest dose possible that will still help you sleep at night. Your doctor will work with you to find the dose of Ambien CR that is best for you.

To manage these side effects while you are taking this medicine:

- When you first start taking Ambien CR or any other sleep medicine until you know whether the medicine will still have some carryover effect in you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
- NEVER drink alcohol while you are being treated with Ambien CR or any sleep medicine. Alcohol can increase the side effects of Ambien CR or any other sleep medicine.
- Do not take any other medicines without asking your doctor first. This includes medicines you can buy without a prescription. Some medicines can cause drowsiness and are best avoided while taking Ambien CR.
- Always take the exact dose of Ambien CR prescribed by your doctor. Never change your dose without talking to your doctor first.

SPECIAL CONCERNS

There are some special problems that may occur while taking sleep medicines.

Memory problems: Sleep medicines may cause a special type of memory loss or "amnesia." When this occurs, a person may not remember what has happened for several hours after taking the medicine. This is usually not a problem since most people fall asleep after taking the medicine.

Memory loss can be a problem, however, when sleep medicines are taken while traveling, such as during an airplane flight and the person wakes up before the effect of the medicine is gone. This has been called "traveler's amnesia."

Be sure to talk to your doctor if you think you are having memory problems. Although memory problems are not very common while taking Ambien CR, in most instances, they can be avoided if you take Ambien CR only when you are able to get a full night's sleep (7 to 8 hours) before you need to be active again.

Tolerance: When sleep medicines are used every night for more than a few weeks, they may lose their effectiveness to help you sleep. This is known as "tolerance". Sleep medicines should, in most cases, be used only for short periods of time, such as 1 or 2 days and generally no longer than 1 or 2 weeks. If your sleep problems continue, consult your doctor, who will determine whether other measures are needed to overcome your sleep problems.

Dependence: Sleep medicines can cause dependence, especially when these medicines are used regularly for longer than a few weeks or at high doses. Some people develop a need to continue taking their medicines. This is known as dependence or "addiction."

When people develop dependence, they may have difficulty stopping the sleep medicine. If the medicine is suddenly stopped, the body is not able to function normally and unpleasant symptoms may occur (see *Withdrawal*). They may find that they have to keep taking the medicines either at the prescribed dose or at increasing doses just to avoid withdrawal symptoms.

All people taking sleep medicines have some risk of becoming dependent on the medicine. However, people who have been dependent on alcohol or other drugs in the past may have a higher chance of becoming addicted to sleep medicines. This possibility must be considered before using these medicines for more than a few weeks.

If you have been addicted to alcohol or drugs in the past, it is important to tell your doctor before starting Ambien or any sleep medicine.

Withdrawal: Withdrawal symptoms may occur when sleep medicines are stopped suddenly after being used daily for a long time. In some cases, these symptoms can occur even if the medicine has been used for only a week or two.

In mild cases, withdrawal symptoms may include unpleasant feelings. In more severe cases, abdominal and muscle cramps, vomiting, sweating, shakiness, and rarely, seizures may occur. These more severe withdrawal symptoms are very uncommon.

Another problem that may occur when sleep medicines are stopped is known as "rebound insomnia." This means that a person may have more trouble sleeping the first few nights after the medicine is stopped than before starting the medicine. If you should experience rebound insomnia, do not get discouraged. This problem usually goes away on its own after 1 or 2 nights.

If you have been taking Ambien CR or any other sleep medicine for more than 1 or 2 weeks, do not stop taking it on your own. Always follow your doctor's directions.

Changes in behavior and thinking: Some people using sleep medicines have experienced unusual changes in their thinking and/or behavior. These effects are not common. However, they have included:

- more outgoing or aggressive behavior than normal
- confusion
- strange behavior
- agitation
- hallucinations
- worsening of depression
- suicidal thoughts

How often these effects occur depends on several factors, such as a person's general health, the use of other medicines, and which sleep medicine is being used.

It is also important to realize that it is rarely clear whether these behavior changes are caused by the medicine, an illness, or occur on their own. In fact, sleep problems that do not improve may be due to illnesses that were present before the medicine was used. If you or your family notice any changes in your behavior, or if you have any unusual or disturbing thoughts, call your doctor immediately.

Pregnancy: Sleep medicines may cause sedation of the unborn baby when used during the last weeks of pregnancy.

Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking Ambien CR.

SAFE USE OF SLEEPING MEDICINES

To ensure the safe and effective use of Ambien CR or any other sleep medicine, you should observe the following cautions:

1. Ambien CR is a prescription medicine and should be used ONLY as directed by your doctor. Follow your doctor's instructions about how to take, when to take, and how long to take Ambien CR. Ambien CR tablets should not be divided, crushed, or chewed, and must be swallowed whole.
2. Never use Ambien CR or any other sleep medicine for longer than directed by your doctor.
3. If you notice any unusual and/or disturbing thoughts or behavior during treatment with Ambien CR or any other sleep medicine, contact your doctor.
4. Tell your doctor about any medicines you may be taking, including medicines you may buy without a prescription. You should also tell your doctor if you drink alcohol. DO NOT use alcohol while taking Ambien CR or any other sleep medicine.
5. Do not take Ambien CR unless you are able to get a full night's sleep before you must be active again. For example, Ambien CR should not be taken on an overnight airplane flight of less than 7 to 8 hours since "traveler's amnesia" may occur.
6. Do not increase the prescribed dose of Ambien CR or any other sleep medicine unless instructed by your doctor.
7. When you first start taking Ambien CR or any other sleep medicine, until you know whether the medicine will still have some carryover effect in you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
8. Be aware that you may have more sleeping problems the first night after stopping Ambien CR or any other sleep medicine.
9. Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking Ambien CR or any other sleep medicine.
10. As with all prescription medicines, never share Ambien CR or any other sleep medicine with anyone else. Always store Ambien CR or any other sleep medicine in the original container that you received it in and store it out of reach of children.
11. Ambien CR works very quickly. You should only take Ambien CR right before going to bed and are ready to go to sleep.

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KAMCHATKA BEARS

Taking No Chances

When curious bears get too close, bring on the fire

The brown bears of Russia's Kamchatka Peninsula are big, fast, and occasionally fearless—not a comforting combination. Photographer **Steve Winter** had plenty of chances to learn that the hard way. While camped in a rickety cabin in the Kronotsky Reserve's Valley of the Geysers, Steve got nervous when a female bear began hanging around. "She came up the steps to the balcony of my room, and the lock on the door was not very good," he says. "At night I jammed a ski pole and chair under the door handle"—low-tech warning if a bear wanted in. "I could grab the flare and pepper spray that I kept by my bed," he says. But he didn't relish a face-off. "If she got in, I would need to jump out the window."

He waited a bit too long to jump when a mother bear charged near Kurilskoye Lake. With three cubs, she offered "a dream shot," says Steve. But then she raced straight for him. When she was two strides away, she veered off into the woods. Steve turned and saw a park warden with a raised shotgun. "He said, 'One second, dead.' I didn't know if he meant the bear, or me."



Vladimir Mosolov of the Kronotsky Reserve waves a flare to scare a bear away from the photographer's cabin.

PHOTO BY STEVE WINTER

GNMENT

COVERING THE WORLD



CONTRIBUTORS



At the Little White Chapel's Tunnel of Vows in Las Vegas, Jodi Cobb shoots Nick and Heather DeSanto's drive-through wedding.

LOVE

Talk about a photo op. While on the hunt for scenes of romantic love at wedding chapels in Las Vegas, photographer **Jodi Cobb** spotted a bright red Jeep in line for drive-through nuptials. Inside, along with the happy couple and the bride's parents, were the couple's three beloved dogs wearing colorful feather boas.

The story took a serious turn for Jodi as she traveled the world examining the role of love. "Americans put so much faith in the idea of romantic love as the basis for permanent happiness," she says. "But many cultures deny it, repress it, fear it, or find it irrelevant to life and social preservation." She came to see love as a human rights issue, particularly for girls. "I have pictures of a 13-year-old girl married for nine years in India"—where child marriage is illegal. "Young women in many cultures have no personal choice. They don't think of happily ever after."

SERENGETI

A parked car caused all the fuss. Traveling through Tanzania's Ngorongoro Conservation Area, photographer **Randy Olson** stopped his vehicle. Lions accustomed to visitors crawled underneath it to catch some shade. The result? A traffic jam. "Tourists came racing in, plumes of dust behind their Land Cruisers, jockeying for position to see the lions," says Randy, who was there to document the impact of tourism on the Maasai and their environment. "I was surrounded and couldn't move at all, so I started photographing the people—and they started wondering why. I said it's the animals *inside* the cars that I'm interested in." Most laughed—and snapped Randy's picture right back.

LUBAVITCH

Before visiting a holy site of the Hasidic Lubavitch community in Crown Heights, Brooklyn, photographer **Carolyn Drake** was told to dress modestly, as is the custom of Lubavitch women. "I took that to mean baggy, and chose loose-fitting jeans," she says. "One glance at the women inside, and I knew I had grossly misinterpreted the meaning of modesty. They were dressed in stylish, form-fitting skirts. But they turned a blind eye to my grubbiness and searched for a prayer book in English so I could follow along."

TALES FROM THE FIELD Find more stories from contributors, including their best, worst, and quirkiest experiences, in Features at **ngm.com/0602.**

PHOTO BY JIM LAURIE

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Who Knew?

PHYSICS

The Fourth State of Matter

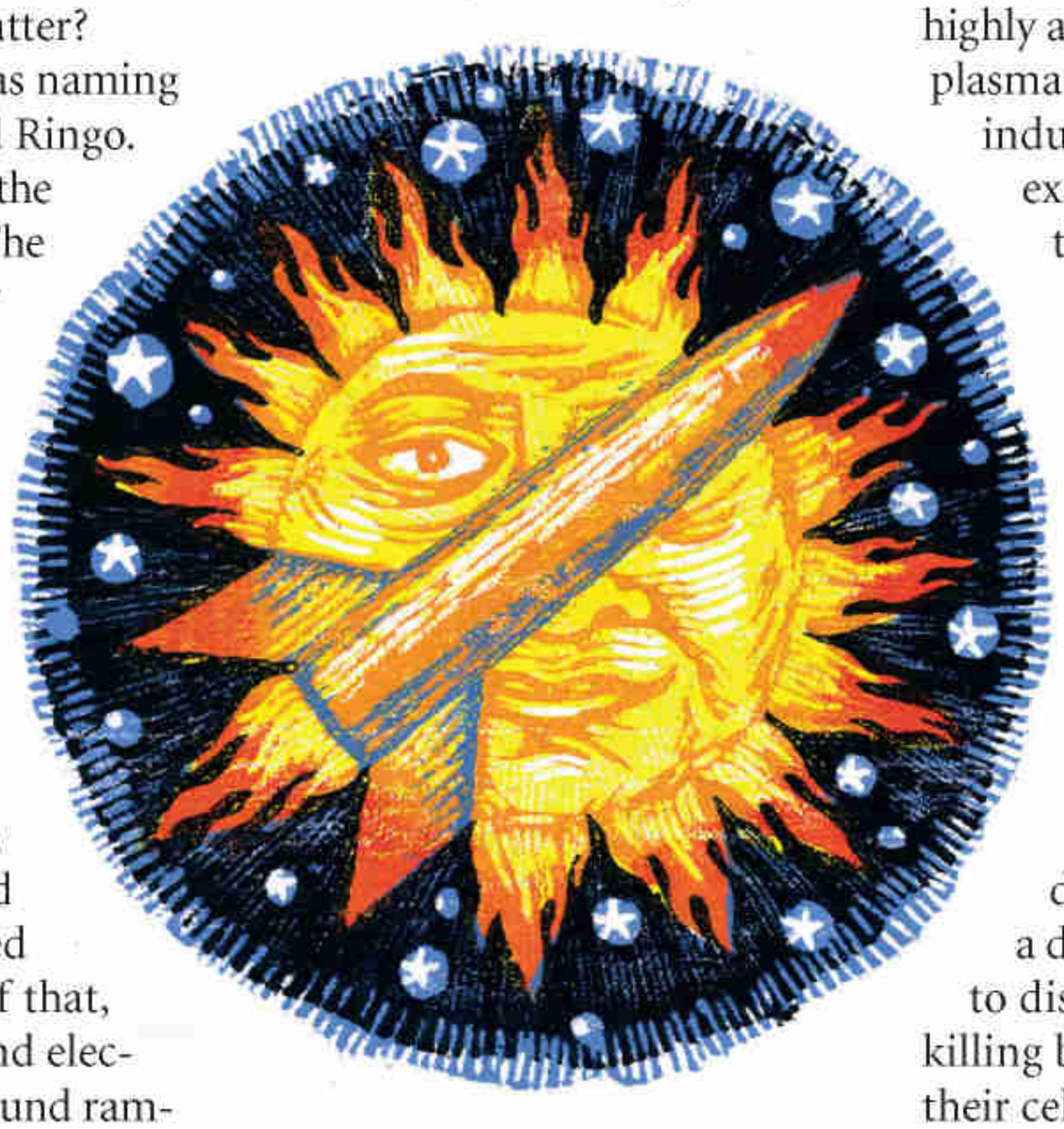
Plasma: not just for TVs

Solid, liquid, gas, and . . . what? Quick, what's the fourth state of matter? This should be as easy as naming John, Paul, George, and Ringo. Ninety-nine percent of the universe is made of it. The Earth is surrounded by it. The aurora borealis is a lovely example of it. So is lightning. The sun is made of it.

"Fire!" you guess, and you're on the right track, at least. The answer is plasma. Perhaps an anticlimax? Plasma is a gas in which atoms have been ionized —that is to say, stripped of electrons. Because of that, plasma has magnetic and electric fields that move around rambunctiously and unpredictably, altering their environment. As the environment changes, so does the plasma—a continuous dance of action and reaction. It's usually hot, but it can also be cold. "Plasma has a life of its own," says Walter Gekelman, who researches the stuff in an enormous basement laboratory at UCLA.

Ionized gas was first described in the late 1800s by an Englishman named Sir William Crookes, but not until 1928 did an American chemist, Irving Langmuir, name it plasma. Names aside, Gekelman and other scientists are still trying to understand the fundamental reasons why it behaves the way it does.

Maybe that's why plasma has never had the respect that a full-fledged state of matter ought to have. But that's likely to change, and not just because of plasma-screen TV. (Not that a plasma screen isn't a pretty nice addition to the family room: Its weakly ionized cold plasma eliminates the ponderous cathode-ray-tube technology that makes your TV too big for the shelf you'd like to keep it on.)



Plasma could be key to new energy sources. The core of the sun is a plasma denser than lead and so hot—15 million degrees C —that atomic nuclei fuse together there, releasing a huge amount of energy. Everyone knows that for many decades scientists have tried to replicate the sun's nuclear fusion feat. They've built reactors that use plasmas heated to tremendous temperatures, but so far they haven't been able to get more energy out than they've put in. They need a bigger reactor.

Still, "plasma's uses are multiplying like crazy," says Gekelman. The rockets of the future may be powered by thin beams of highly accelerated plasma. Cold plasma is essential to many industrial operations: For example, it's used to etch the grooves that carry information on the surfaces of computer chips.

Mounir Laroussi, a physicist at Old Dominion University, has developed a sort of pencil that shoots out a small stream of cold plasma. It can sterilize equipment that would normally be damaged by heat. Such a device might even be used to disinfect a flesh wound, killing bacteria by blowing out their cell walls without harming other cells. Plasma makes the fibers in disposable diapers more absorbent and makes ink lettering stick to plastic potato-chip bags.

Laroussi says that when he was in high school he never heard about plasma. But there's so much of it in the universe, and it has so many potential uses, that there will come a day, he predicts, when everyone knows that it's the fourth state of matter.

—Joel Achenbach

WASHINGTON POST STAFF WRITER

ILLUSTRATION BY SAM HUNDLEY

HEARTBREAK ON

Wildebeests and wattled starlings begin their annual migration at the edge of the Serengeti Plain, where humans live in wary coexistence with their wild neighbors.



THE SERENGETI

TOURIST INVASION *Camera-wielding visitors pour into Ngorongoro Crater to stalk lions, elephants, and other survivors of a wild Africa that is fading. A top attraction, this extinct caldera brings welcome revenue to Tanzania, one of the poorest nations on Earth. But the tourists—some 250,000 in 2004—also crowd narrow roads, strain scarce water resources, and disrupt wildlife.*





ARRESTED *In dusty Kitunguruma, antipoaching rangers take a woman, Boke-Morwa, into custody. She was charged with possession of an impala skin and released after questioning. Fueled by explosive population growth, settlements such as hers cram the western borders of Serengeti National Park and its buffer zones, where impoverished hunters may kill as many as 200,000 animals each year.*

BY ROBERT M. POOLE
PHOTOGRAPHS BY RANDY OLSON



CONFERENCE OF ELDERS *Wrapped in their traditional* shuka, *Maasai leaders gather to discuss the building of a village school on the vast grassland their ancestors named* siringet, *"the place where the land runs on forever." Maasai worry that they are being squeezed out. "The government is more interested in wild animals than they are in the people," says one.*

THE MAASAI PEOPLE OF EAST AFRICA, who have always gone their own way, do not count the years as others do. For them each 12-month span contains two years—a year of plenty, *olaari,* coinciding with the rainy season on the immense Serengeti Plain and Crater Highlands of Tanzania, followed by a year of hunger, *olameyu,* commencing when the rains cease, the streams run dry, and the great wildebeest migration, more than a million strong, thunders off toward the north in search of food and water. Then the Serengeti grass turns the color of toast and crackles underfoot, and the Maasai herd boys and warriors embark on long, loping marathons to find sustenance for their beloved cattle, which remain the measure of wealth and well-being in this pastoral society.



The year of hunger was several weeks old by mid-July, when the clouds tumbled and split over Ngorongoro Crater, illuminating a drama already in progress on the crater floor.

There in the yellow light a pride of lions padded up out of a streambed, intent on a

herd of grazing zebras; a lone hyena, big shouldered and narrow hipped, maneuvered among skittish warthogs; and a pair of cheetahs sat alert in tall grass, almost invisible as they scrutinized a hundred Thomson's gazelles with professional interest. Sharp-eyed vultures surveyed the morning from above, wheeling through white salt clouds whipped up from Lake Magadi.

The night belonged to the animals, but morning brought people down into the crater—Maasai to water and browse their hundreds of cattle, biologists to study the rhythms of life among elephants and lions, tourists to ogle the Maasai herders and the varied wildlife for which this part of East Africa is justifiably famous. People, wildlife, and livestock all converged here on a typical day, living in a workable—but inevitably wary—coexistence.

The first cattle appeared about eight o'clock, inching in single file down the steep, narrow track to the crater floor, urged along by a Maasai warrior named Moma, who would walk for 12 hours with his herd on this long day. A red cumulus of dust marked Moma's progress down the escarpment trail; he made a melody of clanging cowbells, singing, and urgent whistling, which grew louder as he trudged into view, first to arrive on the crater floor. Like most Maasai, he was lean from a meager diet and much walking, and he looked like a biblical prophet in his dusty sandals and red toga, which billowed and flapped in the cold wind. He carried a long spear in one hand as he whistled his herd of 80 down to the spring, left them guzzling there, and strode over to take his measure of the pasty looking tourists who had just arrived in the crater, the first of hundreds who would spend the day there.

They brandished cameras when they saw Moma, who struck a proud pose with his spear, his plaited hair bright with beads and bars of aluminum that caught the sun, his earrings dangling from pendulous lobes, his skin smeared bright with animal fat.

"Man," cried a distinctly American voice behind one of the cameras, "this looks just like a NATIONAL GEOGRAPHIC picture!" Moma stepped over to view his own image on the camera screen and to relieve his portraitist of a thousand Tanzanian shillings (about a dollar). He collected similar sums from two other tourists.

"What would you do if a lion attacked your cows?" someone asked.

"I would put this spear right in him!" Moma declared, banging his weapon on the ground to emphasize the heartfelt sentiment. Maasai have never been hunters, but they are fierce in their defense of the herd, and they kill a lion or two when circumstances require it.

Moma stuffed the shilling notes deep inside his robe and, morning rounds accomplished, reentered the world of his ancestors: a gaunt figure guiding his herd through another dry winter in a land haunted by lions and hunger. The khaki-clad tourists, meanwhile, popped open the top hatches of their Land Rovers, emerged from the roofs like tank commanders, and rumbled off in a haze of diesel fumes to hunt for other exotic sights.

THEY WOULD FIND THE WILDLIFE thriving on their safari, much as it does elsewhere in the heart of Serengeti National Park and its companion Ngorongoro Conservation Area, contiguous protected regions comprising more than 8,000 square miles of rolling grassland, acacia woodlands, and mist-draped volcanic highlands in northern Tanzania. This area sustains the largest community of migrating ungulates in the world, as well as its greatest concentrations of large predators.

Surveys show the wildebeest population at about 1.2 million, a recent high number for this keystone antelope species, which annually renews the Serengeti's pastures with its massive grazing, trampling, and droppings; the shaggy wildebeest also provides ready prey for lions, hyenas, and other predators. Healthy populations of zebras, numbering more than 200,000, hold steady throughout the region; elephants, which virtually vanished during the ivory-poaching days of the late 1980s, have bounced back, now totaling more than 2,000; black rhinos are stable; lions are on the upswing, numbering 3,500, despite earlier setbacks from disease; populations of impalas, topi, eland, gazelles, giraffes, and Cape buffalo are at healthy levels and rising. The only animals in decline seem to be the wild dog and the warthog. On a continent where much of the wildlife has been wiped out, the picture remains generally favorable in the protected areas.

"The Serengeti itself is in good health," said Christiane Schelten, a program officer with the Frankfurt Zoological *(Continued on page 15)*

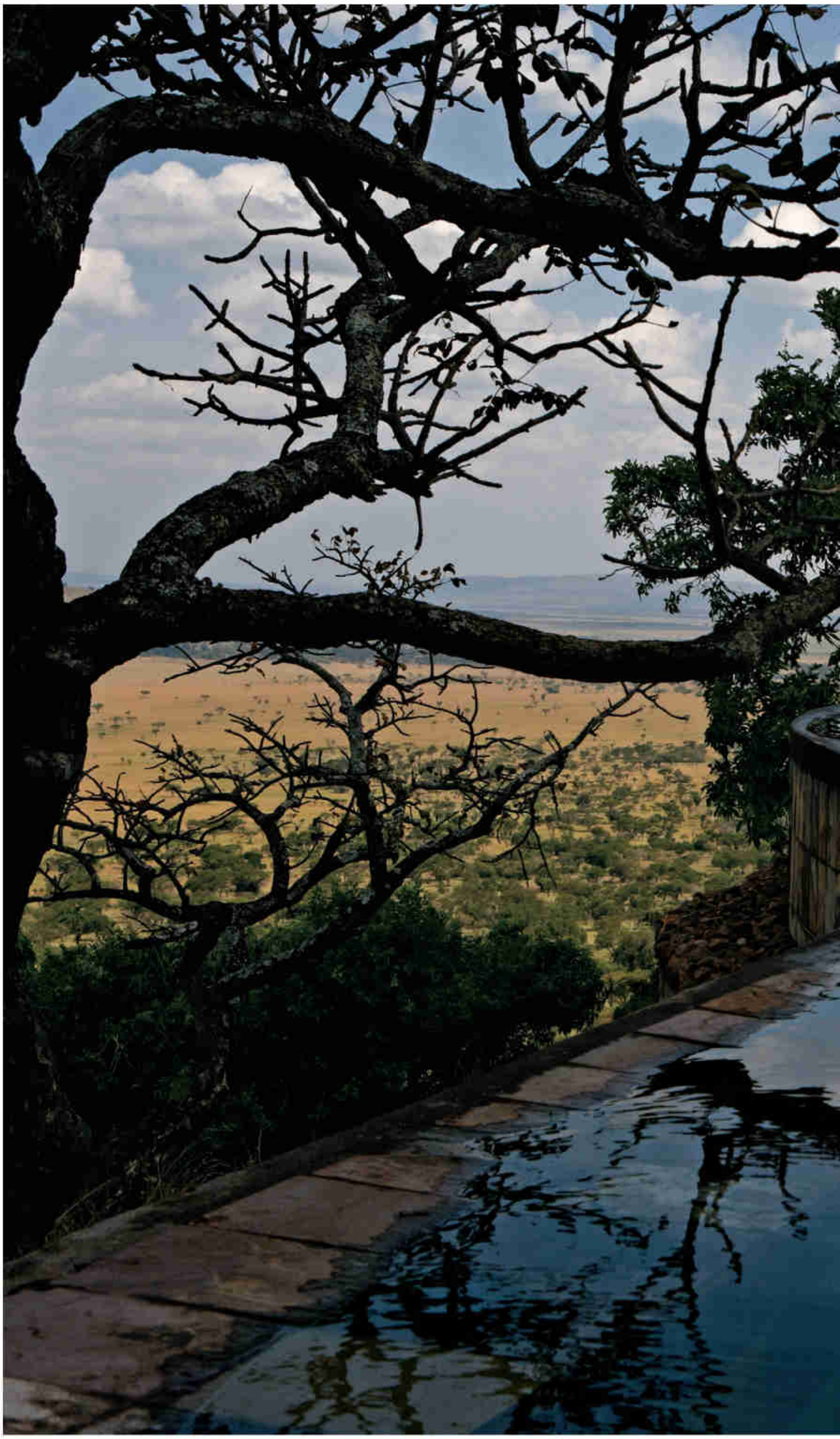
LIFE'S RISKS *To find dry-season browsing and water along the Grumeti River outside Serengeti National Park, elephants cross the busy main road. Another danger—poaching—reduced the park's elephants to a few hundred before a ban on international ivory sales in 1990; since then the population has bounced back to over 2,000. Elephants wander outside the park, coming into conflict with people.*



THE SERENGETI

Shaped by tectonic shifts and volcanic pressures, the Serengeti-Mara region supports a stunning collection of parks and wildlife reserves. Healthy populations of predators rely on the keystone species, the wildebeest, now thought to number around 1.2 million. These members of the antelope family bring life to the African plains, renewing the grasslands by their wide-ranging grazing and their droppings. People have also helped write the region's long history: hominin ancestors in Olduvai Gorge; tribes of traditional hunters who once roamed the Serengeti; and nomadic Maasai who still follow their herds in the Ngorongoro Conservation Area, a multiple-use zone where wildlife, tourists, and indigenous people are supposed to exist in harmony—but seldom do.





WATER FOR THE FEW *Workers tidy up a swimming pool at Sasakwa Lodge, which draws high-paying tourists to the Grumeti Reserves, contiguous to Serengeti National Park. With big fees from trophy hunting and safaris, Grumeti pays for antipoaching patrols and community development. Praised by conservationists, the program is scorned by some villagers. "They think they can buy anything," says a local leader.*



GLAD FOR THE WORK *In Tanzania 36 percent live below the poverty line, and desperate villagers supplement their income with poaching or seasonal jobs in the tourist trade. At Sasakwa Lodge, where rooms rent for $1,500 a night, workers plant grass and clean house (above and below) to create what a lodge manager describes as a "world-class experience."*



"We want to bring the millionaires in here and squeeze as much money out of them as we can. The more money we squeeze out of them, the more we will put back into the community." —RIAN LABUSCHAGNE

Society, which advises the Tanzanian government on conservation. "It's intact, and it seems to be working."

It would be nice to end the story on that note, but the narrative becomes less hopeful when one exits the parks to explore the larger Serengeti-Mara ecosystem, where the future of the region's wildlife and people is being written. This larger area, defined by the annual wanderings of the wildebeest herd, wraps around the Serengeti, sprawling over some 10,400 square miles of Tanzania and southwestern Kenya, from the Crater Highlands and Great Rift Valley in the east, across the grassy plains and woodlands of the Serengeti interior, westward down a narrow corridor of hills and scattered woodlands leading to Lake Victoria, and finally northward across the Kenya border to the Masai Mara National Reserve, a small but critical haven where migrating animals find plentiful forage and water in the dry season.

Once sparsely settled and hospitable to the Serengeti's wildlife, the ecosystem has shrunk to half its former size, eroded in the 20th century by booming human populations in Tanzania and Kenya. In Tanzania, where the numbers have tripled to more than 36 million since the country won its independence in the early 1960s, Serengeti and Ngorongoro have become islands of wilderness washed by a rising sea of humanity, with people pressing right up against the patchwork of game reserves and conservation areas that buffer the protected core. Land is at a premium in this poor country of farmers, where less than 5 percent of the earth is cultivated and a quarter of the land is reserved for parks. Almost 40 percent of the populace lives below the poverty line.

Day and night, people steal into Serengeti to poach wood for building and cooking and to hunt resident and migratory wildlife in increasing numbers. Their proximity to the park brings native Tanzanians into constant conflict with wildlife.

"You see more farms, more livestock, more cotton and rice cultivation moving toward the park each year," said Justin Hando, chief warden for Serengeti National Park. "People who used to live 80 kilometers from the park now live five or six kilometers away—so it's much easier for them to engage in illegal activity. The animals from the park try to do what they have always done—they cross back and forth over the boundaries. The difference now is that the free movement of animals is no longer possible," said Hando. "They have more interaction with people."

That interaction is not always heartening. During several weeks of exploring the Serengeti and Ngorongoro region, I confirmed many reports of human-wildlife conflict—an elephant stomping and killing a villager armed with a bow and arrow in Robanda; black rhinos bolting in Ngorongoro Crater, where tourists in cars had approached too fast and too close, sending the animals fleeing; poachers setting out hundreds of wire snares on the park's western borders in hope of snagging a wildebeest, a zebra, or some other protein-rich ungulate for the table or for the lucrative traffic in wild meat. The illegal bushmeat trade, a rising threat in almost all of Africa's protected areas, annually feeds an estimated one million people in northern Tanzania alone.

The wire snare—preferred by poachers because it is a cheap and silent method of taking game—is also indiscriminate, grabbing any passing animal unlucky enough to step into a noose secured to a tree. This method recently hooked a Serengeti giraffe around the leg, a lioness around the neck, and a wildebeest by the horns. Another lion, snared in the western corridor outside the park, wrestled himself free of his wire noose, cutting off his hind leg in the process; he has been seen galumphing through the bush on three legs, a sturdy survivor who dominates his territory.

Twenty years ago, when the pressures of population were less, few Serengeti scientists worried unduly about poaching. "It would not be correct

"I know where I am from," said Jombi Ole Kivuyo, who recently traded his warrior's spear for an apartment and a paycheck in Arusha. "But I don't know where I am going."

to call killing an antelope or zebra or wildebeest to feed one's family meat poaching," said Markus Borner, the Frankfurt Zoological Society's top scientist in the region, interviewed for a NATIONAL GEOGRAPHIC article in 1986. Now, however, with the market for wild meat flourishing in Africa, villagers around the park can make more money by hunting in the Serengeti than they can by almost any other activity, so the annual harvest of animals in the ecosystem has risen dramatically in recent years. Because hunting is illegal, precise figures are hard to come by. Estimates of the poaching toll range from a low of 40,000 animals a year to a high of 200,000, most of them wildebeests. Such a harvest cannot be sustained at the higher figure without causing fundamental damage to the ecosystem.

"YOU CAN ONLY REMOVE so many nuts out of an airplane before it falls out of the sky and crashes," said Rian Labuschagne, managing director of the Grumeti Reserves, an enterprise that recently leased almost 280,000 acres of hunting concessions in the western Serengeti to restore the beleaguered ecosystem from the outside in.

Bankrolled by Paul Tudor Jones, a futures trader and visionary American conservationist, the Grumeti Reserves project has already invested at least 20 million dollars in Tanzania to conserve vital migratory habitat in the western corridor; to crack down on illegal hunting by indigenous Africans; and to help struggling villages outside the park by building schools, drilling new wells, providing scholarships, creating tourist jobs, and training farmers in beekeeping and aquaculture—all aimed at weaning citizens away from poaching.

How to pay for this ambitious scheme? Easy: You build one of the world's most exclusive safari lodges on a bluff overlooking the sweeping Sabora Plains, fill the lodge with Victorian antiques and millionaires, charge the high rollers $1,500 a night, and collect additional trophy fees when they go out to hunt for lions and buffalo. You coddle guests with a health spa, two tennis courts, a yoga room, a state-of-the-art exercise facility, and gourmet meals by a Cypriot chef. You build an infinity pool on the edge of the bluff, affording a panoramic view for those who like to soak while watching their wildebeests. You make the experience special by banning anyone except paying guests from your private preserve.

After operating costs are covered, any excess from the Grumeti Reserves goes to a subsidiary known as the Grumeti Fund, which will pour its resources into community development and security.

"We dream a bit wide," said Labuschagne, a bluff South African with an unstoppable conversational style that leaves visitors gasping in his wake. We chatted in the welcome shade of a massive acacia on a July morning, as workers put the finishing touches on Sasakwa Lodge. This gleaming 18-bed centerpiece of the Grumeti resort had just received its first guests, which he marks as a turning point for conservation in Tanzania.

"We are taking care of this world-class resource and creating something that will be sustainable for the next hundred years," said Labuschagne, a veteran conservationist who earned his spurs restoring black rhinos in Ngorongoro Crater. "We want to bring the millionaires like Ted Turner in here and squeeze as much money out of them as we can. The more money we squeeze out of them, the more we will put back into the community, so that people in the villages can finally have some money in their pockets. They have to get something out of it too."

It remains to be seen whether the big spending of Paul Tudor Jones, combined with the big ideas of Rian Labuschagne, will succeed in Tanzania. Conservationists are cautiously optimistic that they will.

"All of these transitional zones around the park are supposed to accommodate both people and



EAGER TO LEARN *Students compete for attention at a new public school in the village of Iharara in the densely populated northwest. Such classrooms are built with government levies on tourist developments. Adult literacy stands at a relatively high 78 percent in Tanzania, where education ends for most after primary school.*

wildlife," said Christiane Schelten. "So far the buffer zones have worked better on paper than they have in reality." At least some conservationists view the Grumeti scheme as a positive alternative to the failed approaches of the past. "A lot of people think that trophy hunting is a horrible thing," she said. "But as long as it's sustainable and you have the right quotas in place, it can be a money earner for the local economy, and with no harm to the resource."

NOT EVERYONE, however, is enamored with the grand vision laid out by Labuschagne and company. In Robanda, a scruffy but vibrant village of 2,763 just outside the western gates of Serengeti National Park, any mention of the Grumeti scheme provokes a sharp response.

"We are their enemy, and they are our enemy!" said Kenyatta Richard Mosaka, the village vice chairman. Like others in his town, Mosaka views the Grumeti people as meddlesome outsiders who want to move them far away, where Robanda's fiercely independent Ikoma people will not interfere with the resort's luxury safaris.

And indeed, this is exactly what Labuschagne would like to do. He supports plans by the Tanzanian government for the Ikoma Wildlife Management Area, which would severely limit hunting, farming, and other human activity in a 96,000-acre wedge surrounding the village.

"Robanda remains the problem," he said. "You've got human activity cutting a wedge out of an ecosystem there." He believes that the village has become a hotbed of the bush-meat trade, and there is independent research to support this view. He also asserts that the town is an obstacle to wildebeest migration in the western migratory corridor.

To remove this barrier, Grumeti has offered to lease village lands and relocate Robanda's citizens. Robandans would retain ownership of their old lands, and they would have a say



in management of the new wildlife area—but they could no longer live there. "Their land would become more valuable with time," said Labuschagne.

Mosaka snorts at this suggestion. "They want to ban us from hunting," he said. "They say that our village interrupts the migration of the wildebeests. Why are there more wildebeests now than ever before? They offered to pay us to move. Our village rejected the offer. Now the people here see a white man and they get angry."

The troubles in Robanda have deep origins, dating from the creation of Serengeti National Park in 1951, when Tanganyika, as Tanzania was then known, was still a colony of Britain. The Ikoma people, a Bantu-speaking tribe of hunters, were booted out of the new park so that they would not interfere with its animals. The displaced settlers came to roost a few miles away in Robanda, where they made the transition from hunting to farming, put down roots, and watched their population flourish. "We've already been moved once before," said Mosaka. "Nobody is eager to move again."

It is easy to see why. Although Robanda is poor, the village thrums with energy and pride, with barefoot children racing through dusty streets, and women squatting beside braziers,



COMMUNITY EFFORT *Just outside Serengeti National Park, leaders from the village of Robanda inspect Ikoma Bush Camp (left and below), incredulous at its creature comforts. The camp's owners have asked Robanda's elders for permission to enlarge the operation. Unlike most other tourist camps, this one employs local villagers exclusively and returns a share of its proceeds to the community. "They are good neighbors," says Kenyatta Richard Mosaka, Robanda's vice chairman.*

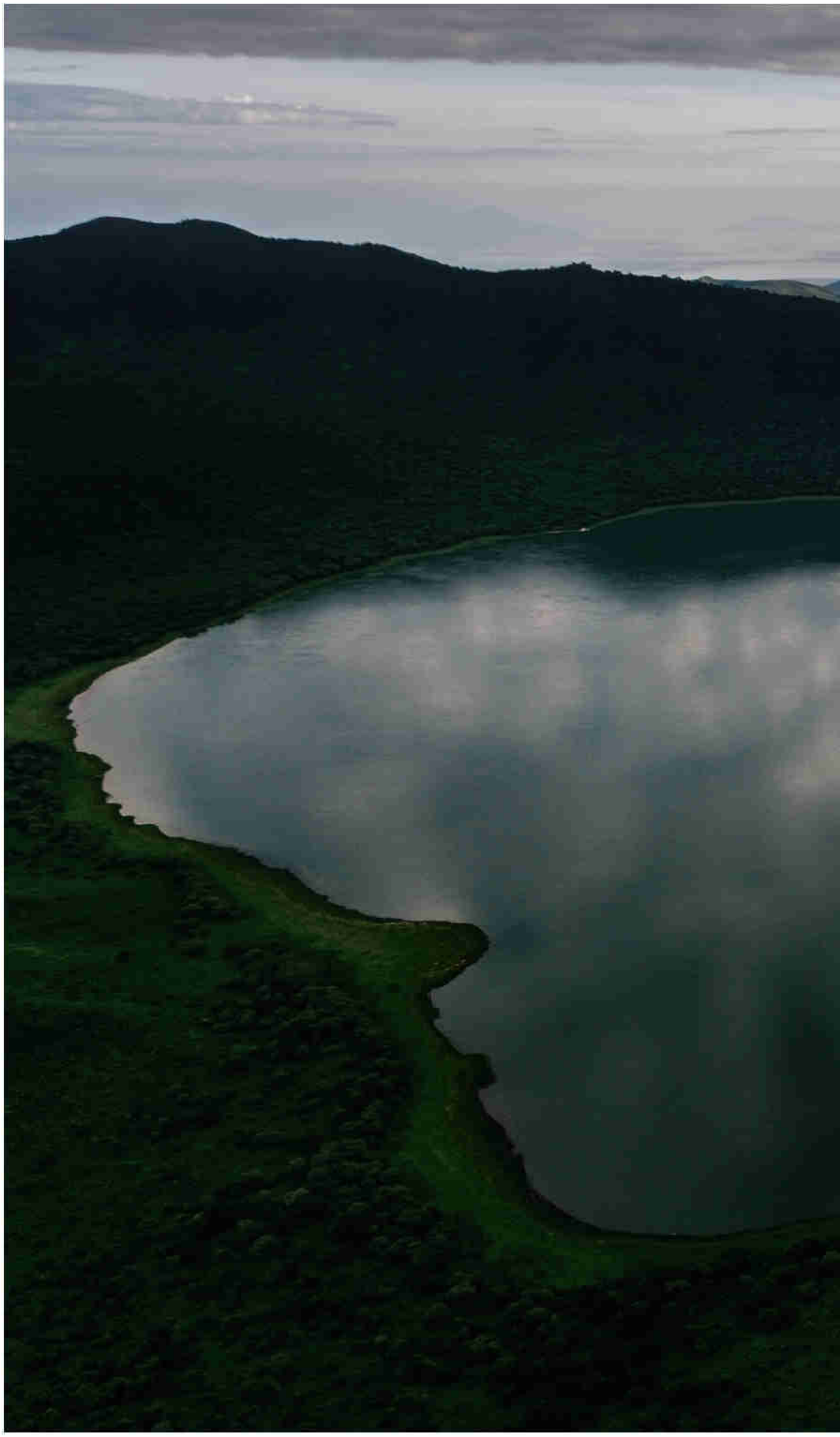


making tea and fried *maandazi* bread on a Sunday morning. Hawkers tout fresh tomatoes and bananas at open stalls, while a contingent of grease-stained men, muttering like surgeons, gathers under a ficus tree to work on the village tractor—all to the constant, thudding rhythm of muscular women pounding millet with a massive mortar and pestle.

Across the street a cell phone goes off, playing "Jingle Bells," and Kenyatta Mosaka, a gangly man in green shorts and a Statue of Liberty T-shirt, comes drifting into view on his black bicycle. The vice chairman of Robanda stops to greet neighbors and to gossip with patrons at the Millennium Y2K Everything You Need Shop.

"It's a good place to live," said Mosaka, propped on his bike while soaking up the benign pageant of life swirling around him. Just beneath the surface, though, tensions boil in Robanda. Determined to crack Robanda's willful habits, the Grumeti Reserves has stepped up its anti-poaching patrols in the region. Nobody in Robanda wants to admit to poaching meat or firewood. Asked about these practices, Mosaka said he knew of no such activity—then he smiled sheepishly and jabbed at his arm as if punching a vein. "Of course if you take some of my blood here, you may find evidence of wild meat in my system."

On several occasions, the Grumeti antipoaching patrols have clashed with villagers, who allege that they were beaten and, in one instance, raped—charges that officials from the Grumeti Reserves dismiss. "The charges are absolutely ill-founded and totally untrue," said Brian Harris, supervisor of the antipoaching squad.



RAIN BARRIER *Adrift in the seas of Tanzania's Crater Highlands, Lake Embakaai mirrors clouds rolling in from the Indian Ocean. By blocking the prevailing moisture, these highlands keep the Serengeti and adjacent plains eternally thirsty. But the forested mountains also store precious reserves of water for times of drought in the Ngorongoro Conservation Area—one reason Maasai consider the highlands sacred.*



FRIENDSHIP DANCE *Near Olduvai Gorge, young Maasai celebrate the end of* orpul *(right), a weeks-long ritual isolation when they learn traditional ways, such as the proper treatment of animals and effective use of medicinal herbs. Orpul is part of their transition from warrior status to that of elders. One such elder prudently collects spears to prevent injury as the spirited dance begins. Meanwhile five Maasai women trudge over the plains to watch the festivities (below).*





"Look," said Labuschagne, "you've got to maintain your boundaries in places like this. You've got to put the law down." If that does not work, he said, it may be necessary to build fences around the park's western boundary to separate elephants and other wildlife from growing human settlements.

FENCES WERE UNKNOWN to the pastoralists like those who first appeared in Greco-Roman literature around 200 B.C. These free-ranging sub-Saharan people went where they pleased, revered their cattle, subsisted on milk and cow's blood, and buried their dead "to the accompaniment of laughter," according to those early accounts. By the 18th century the Maasai had established a strong presence in the Great Rift Valley, where they controlled much of the interior and stamped the land with their own descriptive names. Perhaps the most famous of these was the word they chose for the heart of their homeland, *siringet,* "the place where the land runs on forever." The Serengeti.

Hope must have seemed as boundless as the horizons for Maasai who lived there. They knew no equals, followed the seasons, delighted in fighting, and deferred to no man. Believing themselves to be God's chosen tribe, entitled to all of the cattle on Earth, they cheerfully raided other tribes to enlarge their own herds, and their reputation for fierceness taught neighbors to give the Maasai a wide berth. Arab slave traders avoided their area, as did the earliest European explorers.

The Maasai remained aloof and self-sufficient until the age of Victoria, when drought, disease,



and trouble brought them low. Thousands died from a cholera epidemic in the 1880s, followed by an outbreak of smallpox in 1892. Then a plague of rinderpest, a bovine viral disease, wiped out most of the Maasai's wealth and nourishment overnight, and civil wars diluted their grip on the region.

Little fight remained in them following World War I, when the British consolidated their grip on Kenya and took control of Tanganyika. On the Serengeti, the British took the first bites out of Maasai holdings in 1929, establishing an 800-acre game reserve for hunting, which became the basis for Serengeti National Park. Maasai continued to live there until 1959, when repeated conflicts with park authorities over land use led the British to evict them.

"THEY PAID US NOTHING," said Ole Serupe, the only surviving Maasai elder who was party to discussions with the British. "We were told to move because they wanted to make a place for the wild animals," he said. A frail old man in three blankets and orange tennis shoes, he now lives with his extended family and a contingent of goats in a fly-specked compound outside of Endulen, a Maasai village on the edge of Ngorongoro's Crater Highlands.

"We have been waiting for water for 50 years. Since the Maasai were first moved out of the park, the government has been making these promises." —RAPHAEL OLOGOLIE

"We refused to move," Ole Serupe said, "because the Serengeti had been the home of our mothers and fathers. Our cattle loved the place. It was a place that even a human could love," he recalled, looking at me through eyes clouded by years in the African sun. "But they made us go. Because I was the senior man among the elders, it was from my hand that they took the Serengeti."

Sitting on a low stool by his hut, Ole Serupe recalled how the British had promised him new land in exchange for the move. "They said we would get a better place to live—one with good water and grass."

The Maasai got nothing of the sort. The British peeled off a 3,000-square-mile parcel to the east of Serengeti National Park and created a new home for the pastoralists in 1959. Designated the Ngorongoro Conservation Area, this reserve encompassed the desolate lands around Olduvai Gorge, the arid plains contiguous to the Serengeti, and a portion of the Crater Highlands, including the Ngorongoro Crater. An experiment in multiple land use, this new territory was to be a refuge for Maasai and their herds, for exceptional wildlife, and for the development of tourism.

Almost 50 years into that experiment, it would appear that wildlife and tourists are thriving in the Ngorongoro Conservation Area, but that the Maasai are struggling. Theirs is the old problem—too many people and too few resources, the same hard calculus that has caused so much conflict on the Serengeti's western borders. Numbers tell the story: The Maasai population has grown fivefold in the conservation area, from around 10,000 in 1954 to more than 50,000 today. At the same time they have less territory, having lost the most fruitful part of their new homeland in 1974, when they were evicted from the crater floor. Constrained by these and other developments, the Maasai face an uncertain future, hemmed in by Serengeti National Park to the west, by Ngorongoro Crater to the east, and by growing communities all around. Because their grazing range is limited, they have been unable to enlarge their herds to match their growing population. The result is that their wealth—still measured in livestock—has evaporated with the years, from an average of more than 26 cattle, goats, and sheep per person in 1960, to 5 for each Maasai today. They are forbidden to supplement their pastoral existence by farming on any scale larger than a subsistence basis out of fear that more intensive cultivation will degrade the area's natural habitat.

Bruno O. P. Kawasange, natural resources chief for the Ngorongoro Conservation Area Authority, worries that the growing Maasai population blocks migratory corridors connecting the Ngorongoro Crater with the Serengeti, an important conduit for lions, wildebeests, zebras, and other animals traveling between the two areas. "We want to make sure that these corridors remain open—especially for the lions," said Kawasange. To make room for the big cats and other wildlife, some 250 Maasai households will be moved.

"We can't support large-scale agriculture in the conservation area," explained B. M. Murunya, the authority's tourism chief. "Conservation does not go along with agriculture." Given how farming and development have encroached on parks and reserves in northern Tanzania, this seems a reasonable concern, but it does little to reassure the hard-pressed Maasai.

"THE WILDLIFE GETS BETTER TREATMENT than the people here," said Francis Ole Syapa, a Maasai living in the windswept foothills of the Crater Highlands, where we sat in a zebra-striped hut and watched the clouds boil up from ruined volcanoes. Syapa was expressing a sentiment I heard from many Maasai. "The area is supposed to be not just for the wildlife," he said. "That's why it was established as a multiple-use area. Understand? We Maasai should be allowed to have our own plan to protect the wildlife, to

HARD LIVING *Herders in Ngorongoro Conservation Area make fences out of thorn acacias to discourage predators from raiding cattle. The government provides few amenities—such as schools, health care, and fresh water—that would encourage permanent settlements here. Near the village of Oloirobi, Maasai draw water from the same muddy pool their cattle use.*



ACACIA CLOTHESLINE *Sick or healthy, married Maasai women, with their shaved heads and luxuriant necklaces, do most of the work in this strongly patriarchal society. They gather wood, make camp, milk cows, and tend babies, while the men lead cattle on the never ending search for grass and water. Once true nomads, many of Tanzania's Maasai have begun the transition to a more settled life.*



"What would you do if a lion attacked your cows?" someone asked. "I would put this spear right in him!" Moma declared, banging his weapon on the ground to emphasize the heartfelt sentiment.

develop tourism, and to decide how the people's lives can be improved here. As it stands now, we have no real say." Syapa pointed out that Maasai hold no key positions within the conservation authority, and that only one serves on the group's advisory board—this, despite his people's overwhelming numbers in the region. "We live here on the land, but we cannot plan for ourselves how to use it. We don't have the same rights as other Tanzanians," he said.

Surely, I suggested, the community must benefit from the millions of dollars flowing to the region—Tanzania's top tourist attraction.

Syapa gave me a long, searching look, followed by a longer silence. He took a swig of Kilimanjaro beer, placed the bottle on the table between us, and spoke with great deliberation: "I really don't have the information," he said, "but I can tell you we don't see very much of that money here."

This was painfully obvious down the red-dirt road in Endulen, a Maasai village of cockeyed plank shacks that looked as if they might blow away on the next wind. So did some of the people in this town of 8,000, which suffers from tuberculosis, malnutrition, and malaria, according to doctors at the region's only hospital. "We also get brucellosis, which comes from drinking unboiled milk, fractures from fighting, and quite a few injuries from buffalo attacks," said Jeanine Heeren, a doctor in Endulen's 80-bed missionary hospital. She also reported that HIV had made its appearance in Endulen, a sign that residents of this community were venturing into the world and bringing new problems to the village.

Endulen was busy, though. Women with shaved heads and jangling silver necklaces picked through oranges and onions in the market, where a butcher in a red robe and baseball cap hung glistening slabs of goat meat in his stalls, watched closely by a pair of hopeful dogs. Warriors with spears led cattle down a path to Olndogom River, which flowed through town.

Half the village seemed to be in and out of the stream—women washing clothes and spreading them to dry on thorn trees, children fetching buckets of water for the school, herders waiting in line with donkeys and cattle for their turn at the stream. Some of the herders, I learned, had walked three or four hours to get here, a rare source of fresh water.

"Nobody could survive without it," said a Maasai who had lived his whole life in Endulen.

The village draws its water from the river because the government has built no infrastructure in this region, which grows bigger and more established with each passing year—with or without government help.

"We have been waiting for water for 50 years," said Raphael Ologolie, an elder I met on the outskirts of Endulen. We sat on the ground outside his neatly fenced compound and talked, Ologolie, sitting with his knees drawn up to his chin, cocooned in a red blanket so that only his head was visible. "Since the Maasai were first moved out of the park, the government has been making these promises—to bring water, to bring schools, to bring health care. Our people are going hungry. They come to my house every day asking for food—a little cornmeal, a little salt, a little sugar, but it's never enough. Nobody has kept a single promise to the Maasai."

For its part, the government says that it will do nothing to encourage permanent settlements in the Ngorongoro Conservation Area, which is supposed to be occupied by Maasai nomads living lightly on the land.

"The idea that pastoral people, people who are moving from place to place, will have a fixed source of water and other amenities that the settled communities have, well, we can't provide those things," said Samson S. Mkumbo, chief manager of community development for the authority. "For those Maasai who want to make the shift from the nomadic life to farming, we are seeking an area outside the Ngorongoro Conservation Area."

Having been uprooted twice before, the Maasai do not want to move again. And whether the



TWO WORLDS MEET *In Ngorongoro Crater, Maasai bring their herds for salt and water, and tourists pay to photograph them. Maasai warriors inspired both fear and admiration among early explorers: "What splendid fellows!" blurted an awestruck 19th-century visitor. Although their wanderings are now constrained, the Maasai maintain traditions while adapting to the modern world.*

government acknowledges it, the Maasai have already settled in to the Ngorongoro region for the long haul, having begun the slow, agonizing transition from the world of nomadism.

They still keep livestock—any Maasai worthy of the name must do so—but they have more goats and sheep than cattle these days, and they spend less time on the land, going out for a day or two rather than weeks or months. They return to live in permanent dwellings, fret about educating their children, take a keen interest in politics, and scratch away at the earth, working in vegetable plots outlawed by the conservation authority. The old ways are fading: Maasai intermarry with neighboring tribes, fewer girls are circumcised, and fewer youths have the stretched and decorated earlobes of old. In Maasai country today, hiking boots, sneakers, and T-shirts ("Washington State Volleyball Band") have begun to replace traditional robes and sandals; and everywhere the twittering of cell phones sings from deep in the folds of Maasai togas. A new generation is leaving the villages to make their way in the world.

"I know where I am from," said one of these educated Maasai, Jombi Ole Kivuyo, who recently traded his warrior's spear for an apartment and a paycheck in Arusha. "But I don't know where I am going. I am like a blind man feeling his way."

This young Maasai may stumble on his journey, but it is more likely that he will survive it, just as his ancestors survived the earlier disruptions of plague, war, eviction, and hunger because they were, to borrow a Maasai phrase, "tough as a hyena's sinew." They remain that way, striding along under the immense African sky, looking for the next hill. □

RISING TENSIONS Can local people, conservationists, and growing numbers of tourists coexist in the Serengeti region? Join our forum. Then view more images in an online-exclusive gallery with tips from the photographer at **ngm.com/0602.**

POLITICS CONSUMES A PARK

Last September Kenya's president gave Amboseli National Park back to the local Maasai, causing an outcry. This illegal action, challenged in the courts, fueled the question: Who should own Kenya's parks?



ELEPHANTS VERSUS PEOPLE *Watered by underground streams from Mount Kilimanjaro, the marshes and grasslands of Amboseli provide a dry-season refuge for 1,400 elephants that draw visitors to Kenya from all over the world. The savannas around Amboseli are also a battleground, where wide-ranging wildlife comes into conflict with growing numbers of Maasai and their cattle.*

JOSEPH SANKALE AND DAVID SITONIK, Maasai who were raised on the dusty plains around Amboseli National Park, understand the cost of preserving wildlife. They know how the animals that attract tourists to this iconic landscape can intrude violently into human lives. They have seen children gored by buffalo while walking to school, family cows crushed by elephants and mauled by lions, and fields of maize and beans trampled or eaten by herds of zebras, eland, and gazelles.

They realize how hard it is to feed and water cattle during the dry season with limited access to the springs and swamps the Kenyan government took when it created the 151-square-mile park in 1974. And both agree that the Kenya Wildlife Service has given the Maasai who live around Amboseli far too little money—less than 2 percent of the 3.4 million dollars received each year from tourism.

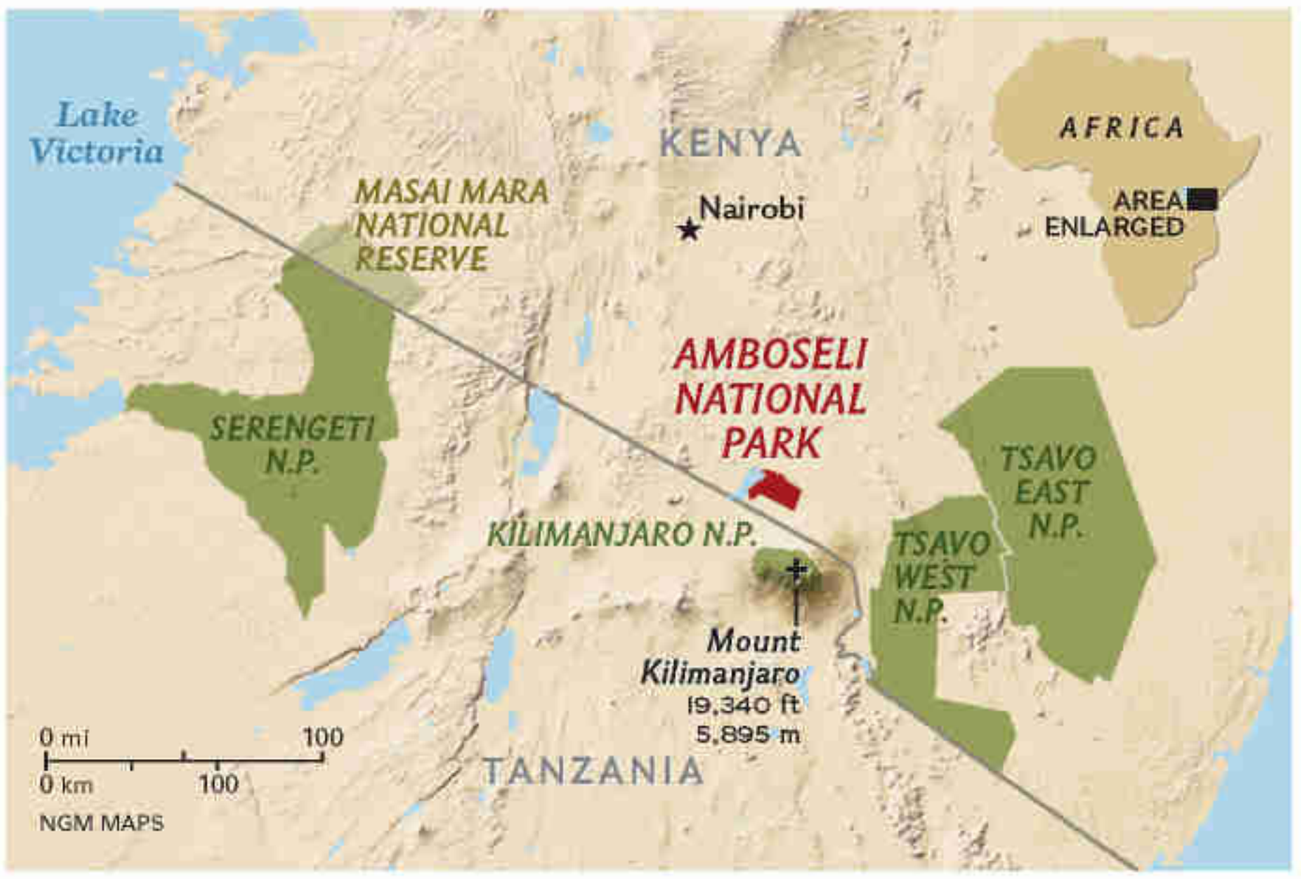
But when it came to President Mwai Kibaki's illegal decision last September to downgrade Amboseli from a park to a reserve and give it back to the Maasai, Sankale and Sitonik parted ways. Sankale, like most Maasai, welcomed the windfall it would bring. Sitonik worried that his people would still end up shortchanged.

Although the long-term consequences of Kibaki's action remain in doubt, the president's move was a sign of the growing political power and deep dissatisfaction of the Maasai and other peoples who live around protected areas. Never before in Africa, never mind in Kenya, had a president tried to unmake a park.

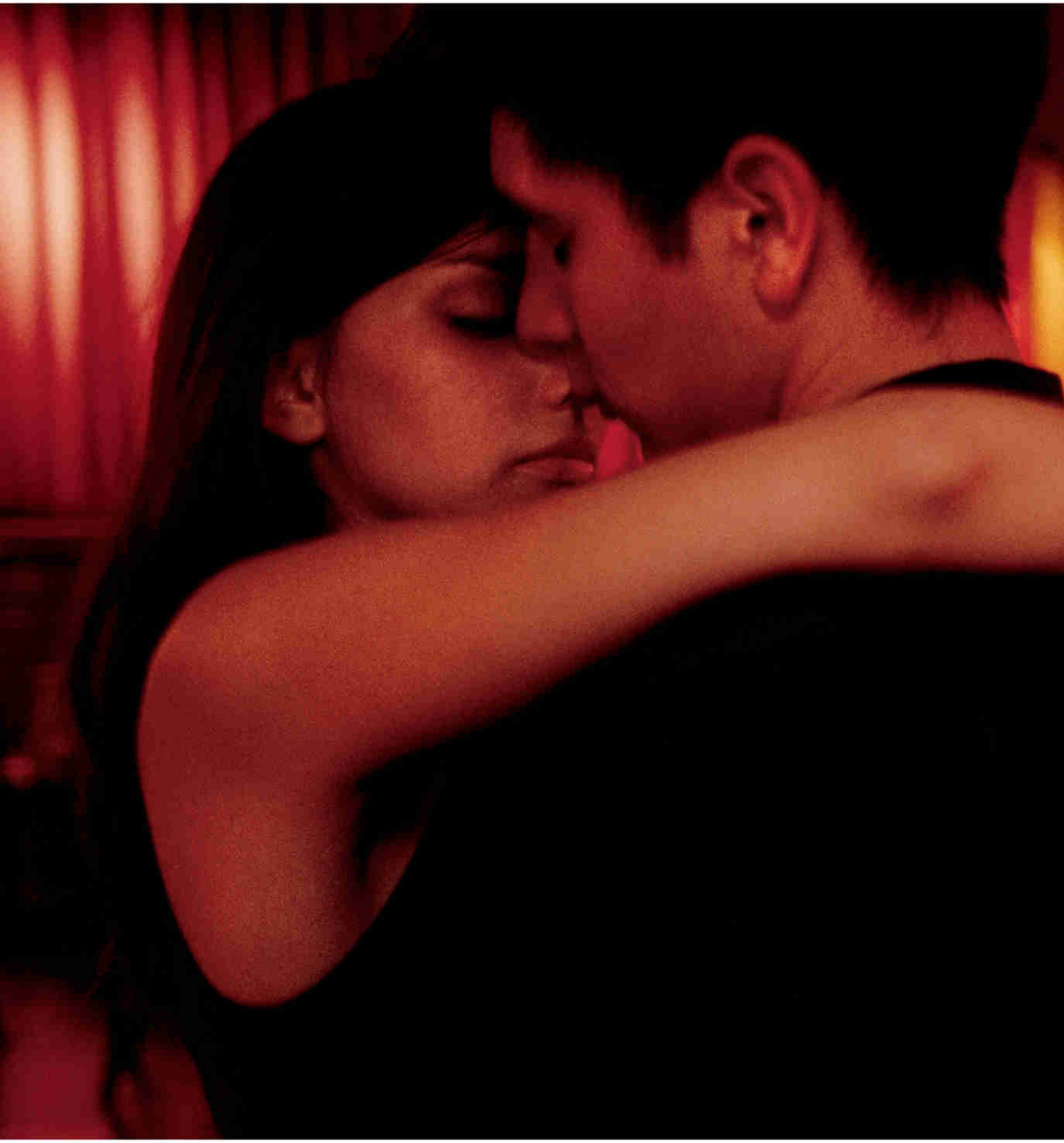
Kibaki turned Amboseli over to the Olkejuado County Council, which represents Maasai in Kenya's south—a move generally seen as a cynical attempt to buy Maasai votes for a new constitution. Sankale supported the downgrading because he didn't see any other way for the Maasai to get a fair share. "Since 1974 we have not benefited at all, at all, at all from the park," said Sankale, a researcher with the privately run Amboseli Elephant Research Project. "This is finally going to help the community."

Sitonik, a recent graduate in wildlife management who also works for the Amboseli Elephant Research Project, feared that the county council would mismanage the fragile ecosystem, that wildlife numbers would drop, and that tourists would stop coming. "If today you are told the Hilton Nairobi is yours, of course you are excited—you calculate the amount the hotel has been getting, and you think that money is yours. But then you have to manage the hotel." Even if large numbers of tourists continued coming to Amboseli, Sitonik wonders how much of the money taken in by the county council would actually reach Maasai who live around the park. "Politicians are not good managers," he said.

Immediately after Kibaki's decision, county councils elsewhere began demanding that the government turn parks over to them. Instead, said Moses Okello, a scientist who studies human-wildlife interactions in Amboseli, the government should be finding ways—like sharing more of the revenues—for local people to benefit from the parks. "The bottom line," he said, "is that Amboseli has been a net loss for the Maasai." —*Karen E. Lange*



PARK UPDATES Monitor Amboseli's status, browse related links in Learn More, and read full-text articles on Africa in our free archive at **ngm.com/0602**.



Courtship at a tango bar in Argentina: First talk, then touch, then moving in perfect rhythm.

PABLO CORRAL VEGA


Scientists are discovering that the cocktail
of brain chemicals that sparks romance is totally
different from the blend that fosters
long-term attachment. So what, really, is this
thing called
love

by Lauren Slater *photographs by Jodi Cobb* NATIONAL GEOGRAPHIC PHOTOGRAPHER

My husband and I got married at eight in the morning. It was winter, freezing, the trees encased in ice and a few lone blackbirds balancing on telephone wires. We were in our early 30s, considered ourselves hip and cynical, the types who decried the institution of marriage even as we sought its status. During our wedding brunch we put out a big suggestion box and asked people to slip us advice on how to avoid divorce; we thought it was a funny, clear-eyed, grounded sort of thing to do, although the suggestions were mostly foolish: Screw the toothpaste cap on tight. After the guests left, the house got quiet. There were flowers everywhere: puckered red roses and fragile ferns. "What can we do that's really romantic?" I asked my newly wed one. Benjamin suggested we take a bath. I didn't want a bath. He suggested a lunch of chilled white wine and salmon. I was sick of salmon.

What can we do that's really romantic? The wedding was over, the silence seemed suffocating, and I felt the familiar disappointment after a longed-for event has come and gone. We were married. Hip, hip, hooray. I decided to take a walk. I went into the center of town, pressed my nose against a bakery window, watched the man with flour on his hands, the dough as soft as skin, pushed and pulled and shaped at last into stars. I milled about in an antique store. At last I came to our town's tattoo parlor. Now I am not a tattoo type person, but for some reason, on that cold silent Sunday, I decided to walk in. "Can I help you?" a woman asked.

"Is there a kind of tattoo I can get that won't be permanent?" I asked.

"Henna tattoos," she said.

She explained that they lasted for six weeks, were used at Indian weddings, were stark and beautiful and all brown. She showed me pictures of Indian women with jewels in their noses, their arms scrolled and laced with the henna markings. Indeed they were beautiful, sharing none of the gaudy comic strip quality of the tattoos we see in the United States. These henna tattoos spoke of intricacy, of the webwork between two people, of ties that bind and how difficult it is to find their beginnings and their ends. And because I had just gotten married, and because I was feeling a post wedding letdown, and because I wanted something really romantic to sail me through the night, I decided to get one.

"Where?" she asked.

"Here," I said. I laid my hands over my breasts and belly.

She raised her eyebrows. "Sure," she said.

I am a modest person. But I took off my shirt, lay on the table, heard her in the back room mixing powders and paints. She came to me carrying a small black-bellied pot inside of which was a rich red mush, slightly glittering. She adorned me. She gave me vines and flowers. She turned my body into a stake supporting whole new gardens of growth, and then, low around my hips, she painted a delicate chain-linked chastity belt. An hour later, the paint dry, I put my clothes back on, went home to find my newly wed one. This, I knew, was my gift to him, the kind of present you offer only once in your lifetime. I let him undress me.

"Wow," he said, standing back.

I blushed, and we began.

We are no longer beginning, my husband and I. This does not surprise me. Even back then, wearing the decor of desire, the serpentining tattoos, I knew they would fade, their red-clay color bleaching out until they were gone. On my wedding day I didn't care.

I do now. Eight years later, pale as a pillowcase,

here I sit, with all the extra pounds and baggage time brings. And the questions have only grown more insistent. Does passion necessarily diminish over time? How reliable is romantic love, really, as a means of choosing one's mate? Can a marriage be good when Eros is replaced with friendship, or even economic partnership, two people bound by bank accounts?

Let me be clear: I still love my husband. There is no man I desire more. But it's hard to sustain romance in the crumb-filled quotidian that has become our lives. The ties that bind have been frayed by money and mortgages and children, those little imps who somehow manage to tighten the knot while weakening its actual fibers. Benjamin and I have no time for chilled white wine and salmon. The baths in our house always include Big Bird.

If this all sounds miserable, it isn't. My marriage is like a piece of comfortable clothing; even the arguments have a feel of fuzziness to them, something so familiar it can only be called home. And yet . . .

In the Western world we have for centuries concocted poems and stories and plays about the cycles of love, the way it morphs and changes over time, the way passion grabs us by our flung-back throats and then leaves us for something saner. If *Dracula*—the frail woman, the sensuality of submission—reflects how we understand the passion of early romance, the *Flintstones* reflects our experiences of long-term love: All is gravel and somewhat silly, the song so familiar you can't stop singing it, and when you do, the emptiness is almost unbearable.

We have relied on stories to explain the complexities of love, tales of jealous gods and arrows. Now, however, these stories—so much a part of every civilization—may be changing as science steps in to explain what we have always felt to be myth, to be magic. For the first time, new research has begun to illuminate where love lies in the brain, the particulars of its chemical components.

Anthropologist Helen Fisher may be the closest we've ever come to having a doyenne of desire. At 60 she exudes a sexy confidence, with corn-colored hair, soft as floss, and a willowy build. A professor at Rutgers University, she lives in New York City, her book-lined apartment near Central Park, with its green trees fluffed out in the summer season, its paths crowded with couples holding hands.

Fisher has devoted much of her career to studying the biochemical pathways of love in all its manifestations: lust, romance, attachment, the way they wax and wane. One leg casually crossed over the other, ice clinking in her glass, she speaks with appealing frankness, discussing the ups and downs of love the way most people talk about real estate. "A woman unconsciously uses orgasms as a way of deciding whether or not a man is good for her. If he's impatient and rough, and she doesn't have the orgasm, she may instinctively feel he's less likely to be a good husband and father. Scientists think the fickle female orgasm may have evolved to help women distinguish Mr. Right from Mr. Wrong."

One of Fisher's central pursuits in the past decade has been looking at love, quite literally, with the aid of an MRI machine. Fisher and her colleagues Arthur Aron and Lucy Brown recruited subjects who had been "madly in love" for an average of seven months. Once inside the MRI machine, subjects were shown two photographs, one neutral, the other of their loved one.

What Fisher saw fascinated her. When each subject looked at his or her loved one, the parts of the brain linked to reward and pleasure—the ventral tegmental area and the caudate nucleus—lit up. What excited Fisher most was not so much finding a location, an address, for love as tracing its specific chemical pathways. Love lights up the caudate nucleus because it is home to a dense spread of receptors for a neurotransmitter called dopamine, which Fisher came to think of as part of our own endogenous love potion. In the right proportions, dopamine creates intense energy, exhilaration, focused attention, and motivation to win rewards. It is why, when you are newly in love, you can stay up all night, watch the sun rise, run a race, ski fast down a slope ordinarily too steep for your skill. Love makes you bold, makes you bright, makes you run real risks, which you sometimes survive, and sometimes you don't.

I first fell in love when I was only 12, with a teacher. His name was Mr. McArthur, and he wore open-toed sandals and sported a beard. I had never had a male teacher before, and I thought





attraction

Cupid's arrow aims not only for the heart during spring break in Cancún, Mexico, where new friends plunge into a type of love defined by physical attraction. Unconscious body language proclaims their readiness: an open-mouth smile, an arched back, avid eyes. Says center of attention Michele Parsons: "Some of us are looking for true love, but most just want sex."

it terribly exotic. Mr. McArthur did things no other teacher dared to do. He explained to us the physics of farting. He demonstrated how to make an egg explode. He smoked cigarettes at recess, leaning languidly against the side of the school building, the ash growing longer and longer until he casually tapped it off with his finger.

What unique constellation of needs led me to love a man who made an egg explode is interesting, perhaps, but not as interesting, for me, as my memory of love's sheer physical facts. I had never felt anything like it before. I could not get Mr. McArthur out of my mind. I was anxious; I gnawed at the lining of my cheek until I tasted the tang of blood. School became at once terrifying and exhilarating. Would I see him in the hallway? In the cafeteria? I hoped. But when my wishes were granted, and I got a glimpse of my man, it satisfied nothing; it only inflamed me all the more. Had he looked at me? Why had he not looked at me? When would I see him again? At home I looked him up in the phone book; I rang him, this in a time before caller ID. He answered.

"Hello?" Pain in my heart, ripped down the middle. Hang up.

Call back. "Hello?" I never said a thing.

Once I called him at night, late, and from the way he answered the phone it was clear, even to a prepubescent like me, that he was with a woman. His voice fuzzy, the tinkle of her laughter in the background. I didn't get out of bed for a whole day.

Sound familiar? Maybe you were 30 when it happened to you, or 8 or 80 or 25. Maybe you lived in Kathmandu or Kentucky; age and geography are irrelevant. Donatella Marazziti is a professor of psychiatry at the University of Pisa in Italy who has studied the biochemistry of lovesickness. Having been in love twice herself and felt its awful power, Marazziti became interested in exploring the similarities between love and obsessive-compulsive disorder.

She and her colleagues measured serotonin levels in the blood of 24 subjects who had fallen in love within the past six months and obsessed about this love object for at least four hours every day. Serotonin is, perhaps, our star neurotransmitter, altered by our star psychiatric medications: Prozac and Zoloft and Paxil, among others. Researchers have long hypothesized that people with obsessive-compulsive disorder (OCD) have a serotonin "imbalance." Drugs like Prozac seem to alleviate OCD by increasing the amount of this neurotransmitter available at the juncture between neurons.

Marazziti compared the lovers' serotonin levels with those of a group of people suffering from OCD and another group who were free from both passion and mental illness. Levels of serotonin in both the obsessives' blood and the lovers' blood were 40 percent lower than those in her normal subjects. Translation: Love and obsessive-compulsive disorder could have a similar chemical profile. Translation: Love and mental illness may be difficult to tell apart. Translation: Don't be a fool. Stay away.

Of course that's a mandate none of us can follow. We do fall in love, sometimes over and over again, subjecting ourselves, each time, to a very sick state of mind. There is hope, however, for those caught in the grip of runaway passion—Prozac. There's nothing like that bicolored bullet for damping down the sex drive and making you feel "blah" about the buffet. Helen Fisher believes that the ingestion of drugs like Prozac jeopardizes one's ability to fall in love—and stay in love. By dulling the keen edge of love and its associated libido, relationships go stale. Says Fisher, "I know of one couple on the edge of divorce. The wife was on an antidepressant. Then she went off it, started having orgasms once more, felt the renewal of sexual attraction for her husband, and they're now in love all over again."

Psychoanalysts have concocted countless theories about why we fall in love with whom we do. Freud would have said your choice is influenced by the unrequited wish to bed your mother, if you're a boy, or your father, if you're a girl. Jung believed that passion is driven by some kind of collective unconscious. Today psychiatrists such as Thomas Lewis from the University of California at San Francisco's School of Medicine hypothesize that romantic love is rooted in our earliest infantile experiences with intimacy, how we felt at the breast, our mother's face, these things of pure unconflicted comfort

Love and obsessive-compulsive disorder could have a similar chemical profile.

Translation: Love and mental illness may be difficult to tell apart. Translation: Don't be a fool. Stay away.

that get engraved in our brain and that we ceaselessly try to recapture as adults. According to this theory we love whom we love not so much because of the future we hope to build but because of the past we hope to reclaim. Love is reactive, not proactive, it arches us backward, which may be why a certain person just "feels right." Or "feels familiar." He or she is familiar. He or she has a certain look or smell or sound or touch that activates buried memories.

When I first met my husband, I believed this psychological theory was more or less correct. My husband has red hair and a soft voice. A chemist, he is whimsical and odd. One day before we married he dunked a rose in liquid nitrogen so it froze, whereupon he flung it against the wall, spectacularly shattering it. That's when I fell in love with him. My father, too, has red hair, a soft voice, and many eccentricities. He was prone to bursting into song, prompted by something we never saw.

However, it turns out my theories about why I came to love my husband may be just so much hogwash. Evolutionary psychology has said good riddance to Freud and the Oedipal complex and all that other transcendent stuff and hello to simple survival skills. It hypothesizes that we tend to see as attractive, and thereby choose as mates, people who look healthy. And health, say these evolutionary psychologists, is manifested in a woman with a 70 percent waist-to-hip ratio and men with rugged features that suggest a strong supply of testosterone in their blood. Waist-to-hip ratio is important for the successful birth of a baby, and studies have shown this precise ratio signifies higher fertility. As for the rugged look, well, a man with a good dose of testosterone probably also has a strong immune system and so is more likely to give his partner healthy children.

Perhaps our choice of mates is a simple matter of following our noses. Claus Wedekind of the University of Lausanne in Switzerland did an interesting experiment with sweaty T-shirts. He asked 49 women to smell T-shirts previously worn by unidentified men with a variety of the genotypes that influence both body odor and immune systems. He then asked the women to rate which T-shirts smelled the best, which the worst. What Wedekind found was that women preferred the scent of a T-shirt worn by a man whose genotype was most different from hers, a genotype that, perhaps, is linked to an immune system that possesses something hers does not. In this way she increases the chance that her offspring will be robust.

It all seems too good to be true, that we are so hardwired and yet unconscious of the wiring. Because no one to my knowledge has ever said, "I married him because of his B.O." No. We say, "I married him (or her) because he's intelligent, she's beautiful, he's witty, she's compassionate." But we may just be as deluded about love as we are when we're *in* love. If it all comes down to a sniff test, then dogs definitely have the edge when it comes to choosing mates.

Why doesn't passionate love last? How is it possible to see a person as beautiful on Monday, and 364 days later, on another Monday, to see that beauty as bland? Surely the object of your affection could not have changed that much. She still has the same shaped eyes. Her voice has always had that husky sound, but now it grates on you—she sounds like she needs an antibiotic. Or maybe you're the one who needs an antibiotic, because the partner you once loved and cherished and saw as though saturated with starlight now feels more like a low-level infection, tiring you, sapping all your strength.

Studies around the *(Continued on page 44)*



romance

"I'd do anything for you," whispers Blair Witherspoon to girlfriend Erica Hoskey. That includes giving her the Tweety Bird he won shooting baskets at the Butler County Fair in Pennsylvania. Sweet talk and gifts fuel romantic passion. But biochemists say this feverish stage of love typically burns out after a few years. Why? Perhaps the brain can't maintain the intense neural activity of infatuation.


LOONEY TUNES


INTRATE ET DICATIONE CONVIVESCITE CUM
DIVO STEPHANO INTERCESSORE NOSTRO
M D L X X V



bonding

Embraced by every culture, marriage sweeps up another couple at a wedding in Varese, Italy. Newlyweds may gush about perfect love, but to anthropologist Helen Fisher, pair-bonding is ultimately driven by the mating instinct, wired into the most primitive part of our brains. "Look at the joy of this man," says Fisher. "He has just won the most important thing in his life: the opportunity to pass along his DNA."

world confirm that, indeed, passion usually ends. Its conclusion is as common as its initial flare. No wonder some cultures think selecting a lifelong mate based on something so fleeting is folly. Helen Fisher has suggested that relationships frequently break up after four years because that's about how long it takes to raise a child through infancy. Passion, that wild, prismatic insane feeling, turns out to be practical after all. We not only need to copulate; we also need enough passion to start breeding, and then feelings of attachment take over as the partners bond to raise a helpless human infant. Once a baby is no longer nursing, the child can be left with sister, aunts, friends. Each parent is now free to meet another mate and have more children.

Biologically speaking, the reasons romantic love fades may be found in the way our brains respond to the surge and pulse of dopamine that accompanies passion and makes us fly. Cocaine users describe the phenomenon of tolerance: The brain adapts to the excessive input of the drug. Perhaps the neurons become desensitized and need more and more to produce the high—to put out pixie dust, metaphorically speaking.

Maybe it's a good thing that romance fizzles. Would we have railroads, bridges, planes, faxes, vaccines, and television if we were all always besotted? In place of the ever evolving technology that has marked human culture from its earliest tool use, we would have instead only bonbons, bouquets, and birth control. More seriously, if the chemically altered state induced by romantic love is akin to a mental illness or a drug-induced euphoria, exposing yourself for too long could result in psychological damage. A good sex life can be as strong as Gorilla Glue, but who wants that stuff on your skin?

Once upon a time, in India, a boy and a girl fell in love without their parents' permission. They were from different castes, their relationship radical and unsanctioned. Picture it: the sparkling sari, the boy in white linen, the clandestine meetings on tiled terraces with a fat, white moon floating overhead. Who could deny these lovers their pleasure, or condemn the force of their attraction?

Their parents could. In one recent incident a boy and girl from different castes were hanged at the hands of their parents as hundreds of villagers watched. A couple who eloped were stripped and beaten. Yet another couple committed suicide after their parents forbade them to marry.

Anthropologists used to think that romance was a Western construct, a bourgeois by-product of the Middle Ages. Romance was for the sophisticated, took place in cafés, with coffees and Cabernets, or on silk sheets, or in rooms with a flickering fire. It was assumed that non-Westerners, with their broad familial and social obligations, were spread too thin for particular passions. How could a collectivist culture celebrate or in any way sanction the obsession with one individual that defines new love? Could a lice-ridden peasant really feel passion?

Easily, as it turns out. Scientists now believe that romance is panhuman, embedded in our brains since Pleistocene times. In a study of 166 cultures, anthropologists William Jankowiak and Edward Fischer observed evidence of passionate love in 147 of them. In another study men and women from Europe, Japan, and the Philippines were asked to fill out a survey to measure their experiences of passionate love. All three groups professed feeling passion with the same searing intensity.

But though romantic love may be universal, its cultural expression is not. To the Fulbe tribe of northern Cameroon, poise matters more than passion. Men who spend too much time with their wives are taunted, and those who are weak-kneed are thought to have fallen under a dangerous spell. Love may be inevitable, but for the Fulbe its manifestations are shameful, equated with sickness and social impairment.

In India romantic love has traditionally been seen as dangerous, a threat to a well-crafted caste system in which marriages are arranged as a means of preserving lineage and bloodlines. Thus the gruesome tales, the warnings embedded in fables about what happens when one's wayward impulses take over.

Today love marriages appear to be on the rise in India, often in defiance of parents' wishes.

Studies around the world confirm that passion usually ends.

No wonder some cultures think selecting a lifelong mate based on something so fleeting is folly.

The triumph of romantic love is celebrated in Bollywood films. Yet most Indians still believe arranged marriages are more likely to succeed than love marriages. In one survey of Indian college students, 76 percent said they'd marry someone with all the right qualities even if they weren't in love with the person (compared with only 14 percent of Americans). Marriage is considered too important a step to leave to chance.

Renu Dinakaran is a striking 45-year-old woman who lives in Bangalore, India. When I meet her, she is dressed in Western-style clothes —black leggings and a T-shirt. Renu lives in a well-appointed apartment in this thronging city, where cows sleep on the highways as tiny cars whiz around them, plumes of black smoke rising from their sooty pipes.

Renu was born into a traditional Indian family where an arranged marriage was expected. She was not an arranged kind of person, though, emerging from her earliest days as a fierce tennis player, too sweaty for saris, and smarter than many of the men around her. Nevertheless at the age of 17 she was married off to a first cousin, a man she barely knew, a man she wanted to learn to love, but couldn't. Renu considers many arranged marriages to be acts of "state-sanctioned rape."

Renu hoped to fall in love with her husband, but the more years that passed, the less love she felt, until, at the end, she was shrunken, bitter, hiding behind the curtains of her in-laws' bungalow, looking with longing at the couple on the balcony across from theirs. "It was so obvious to me that couple had married for love, and I envied them. I really did. It hurt me so much to see how they stood together, how they went shopping for bread and eggs."

Exhausted from being forced into confinement, from being swaddled in saris that made it difficult to move, from resisting the pressure to eat off her husband's plate, Renu did what traditional Indian culture forbids one to do. She left. By this time she had had two children. She took them with her. In her mind was an old movie she'd seen on TV, a movie so strange and enticing to her, so utterly confounding and comforting at the same time, that she couldn't get it out of her head. It was 1986. The movie was *Love Story.*

"Before I saw movies like *Love Story,* I didn't realize the power that love can have," she says.

Renu was lucky in the end. In Mumbai she met a man named Anil, and it was then, for the first time, that she felt passion. "When I first met Anil, it was like nothing I'd ever experienced. He was the first man I ever had an orgasm with. I was high, just high, all the time. And I knew it wouldn't last, couldn't last, and so that infused it with a sweet sense of longing, almost as though we were watching the end approach while we were also discovering each other."

When Renu speaks of the end, she does not, to be sure, mean the end of her relationship with Anil; she means the end of a certain stage. The two are still happily married, companionable, loving if not "in love," with a playful black dachshund they bought together. Their relationship, once so full of fire, now seems to simmer along at an even temperature, enough to keep them well fed and warm. They are grateful.

"Would I want all that passion back?" Renu asks. "Sometimes, yes. But to tell you the truth, it was exhausting."

From a physiological point of view, this couple has moved from the dopamine-drenched state of romantic love to the relative quiet of an oxytocin-induced attachment. Oxytocin is a hormone that promotes a feeling of connection, bonding. It is released when we hug our long-term spouses, or our children. It is released when a mother nurses her infant. Prairie voles, animals with high levels of oxytocin, mate for life. When scientists block oxytocin receptors





attachment

What's kept Emily and Marion Grillot married for 58 years? It may be the bond forged by having children—20 of them, plus 77 grandkids, many pictured in the Grillots' Ohio home. It could be the calming effect of oxytocin, a chemical thought to be plentiful in long-term couples. For Mr. Grillot, a farmer, "it's our commitment and concern for one another. Some call it love."

in these rodents, the animals don't form monogamous bonds and tend to roam. Some researchers speculate that autism, a disorder marked by a profound inability to forge and maintain social connections, is linked to an oxytocin deficiency. Scientists have been experimenting by treating autistic people with oxytocin, which in some cases has helped alleviate their symptoms.

In long-term relationships that work—like Renu and Anil's—oxytocin is believed to be abundant in both partners. In long-term relationships that never get off the ground, like Renu and her first husband's, or that crumble once the high is gone, chances are the couple has not found a way to stimulate or sustain oxytocin production.

"But there are things you can do to help it along," says Helen Fisher. "Massage. Make love. These things trigger oxytocin and thus make you feel much closer to your partner."

Well, I suppose that's good advice, but it's based on the assumption that you still want to have sex with that boring windbag of a husband. Should you fake-it-till-you-make-it?

"Yes," says Fisher. "Assuming a fairly healthy relationship, if you have enough orgasms with your partner, you may become attached to him or her. You will stimulate oxytocin."

This may be true. But it sounds unpleasant. It's exactly what your mother always said about vegetables: "Keep eating your peas. They are an acquired taste. Eventually, you will come to like them."

But I have never been a peas person.

It's 90 degrees on the day my husband and I depart, from Boston for New York City, to attend a kissing school. With two kids, two cats, two dogs, a lopsided house, and a questionable school system, we may know how to kiss, but in the rough and tumble of our harried lives we have indeed forgotten how to *kiss*.

The sky is paved with clouds, the air as sticky as jam in our hands and on our necks. The Kissing School, run by Cherie Byrd, a therapist from Seattle, is being held on the 12th floor of a rundown building in Manhattan. Inside, the room is whitewashed; a tiled table holds bottles of banana and apricot nectar, a pot of green tea, breath mints, and Chapstick. The other Kissing School students—sometimes they come from as far away as Vietnam and Nigeria—are sprawled happily on the bare floor, pillows and blankets beneath them. The class will be seven hours long.

Byrd starts us off with foot rubs. "In order to be a good kisser," she says, "you need to learn how to do the foreplay before the kissing." Foreplay involves rubbing my husband's smelly feet, but that is not as bad as when he has to rub mine. Right before we left the house, I accidentally stepped on a diaper the dog had gotten into, and although I washed, I now wonder how well.

"Inhale," Byrd says, and shows us how to draw in air.

"Exhale," she says, and then she jabs my husband in the back. "Don't focus on the toes so much," she says. "Move on to the calf."

Byrd tells us other things about the art of kissing. She describes the movement of energy through various chakras, the manifestation of emotion in the lips; she describes the importance of embracing all your senses, how to make eye contact as a prelude, how to whisper just the right way. Many hours go by. My cell phone rings. It's our babysitter. Our one-year-old has a high fever. We must cut the long lesson short. We rush out. Later on, at home, I tell my friends what we learned at Kissing School: We don't have time to kiss.

A perfectly typical marriage. Love in the Western world.

Luckily I've learned of other options for restarting love. Arthur Aron, a psychologist at Stony Brook University in New York, conducted an experiment that illuminates some of the mechanisms by which people become and stay attracted. He recruited a group of men and women and put opposite sex pairs in rooms together, instructing each pair to perform a series of tasks, which included telling each other personal details about themselves. He then asked each couple to stare into each other's eyes for two minutes. After this encounter, Aron found

Novelty triggers dopamine in the brain, which stimulates feelings of attraction.

So riding a roller coaster on a first date is more likely to lead to second and third dates.

most of the couples, previously strangers to each other, reported feelings of attraction. In fact, one couple went on to marry.

Fisher says this exercise works wonders for some couples. Aron and Fisher also suggest doing novel things together, because novelty triggers dopamine in the brain, which can stimulate feelings of attraction. In other words, if your heart flutters in his presence, you might decide it's not because you're anxious but because you love him. Carrying this a step further, Aron and others have found that even if you just jog in place and then meet someone, you're more likely to think they're attractive. So first dates that involve a nerve-racking activity, like riding a roller coaster, are more likely to lead to second and third dates. That's a strategy worthy of posting on Match.com. Play some squash. And in times of stress—natural disasters, blackouts, predators on the prowl—lock up tight and hold your partner.

In Somerville, Massachusetts, where I live with my husband, our predators are primarily mosquitoes. That needn't stop us from trying to enter the windows of each other's soul. When I propose this to Benjamin, he raises an eyebrow.

"Why don't we just go out for Cambodian food?" he says.

"Because that's not how the experiment happened."

As a scientist, my husband is always up for an experiment. But our lives are so busy that, in order to do this, we have to make a plan. We will meet next Wednesday at lunchtime and try the experiment in our car.

On the Tuesday night before our rendezvous, I have to make an unplanned trip to New York. My husband is more than happy to forget our date. I, however, am not. That night, from my hotel room, I call him.

"We can do it on the phone," I say.

"What am I supposed to stare into?" he asks. "The keypad?"

"There's a picture of me hanging in the hall. Look at that for two minutes. I'll look at a picture I have of you in my wallet."

"Come on," he says.

"Be a sport," I say. "It's better than nothing."

Maybe not. Two minutes seems like a long time to stare at someone's picture with a receiver pressed to your ear. My husband sneezes, and I try to imagine his picture sneezing right along with him, and this makes me laugh.

Another 15 seconds pass, slowly, each second stretched to its limit so I can almost hear time, feel time, its taffy-like texture, the pop it makes when it's done. Pop pop pop. I stare and stare at my husband's picture. It doesn't produce any sense of startling intimacy, and I feel defeated.

Still, I keep on. I can hear him breathing on the other end. The photograph before me was taken a year or so ago, cut to fit my wallet, his strawberry blond hair pulled back in a ponytail. I have never really studied it before. And I realize that in this picture my husband is not looking straight back at me, but his pale blue eyes are cast sideways, off to the left, looking at something I can't see. I touch his eyes. I peer close, and then still closer, at his averted face. Is there something sad in his expression, something sad in the way he gazes off?

I look toward the side of the photo, to find what it is he's looking at, and then I see it: a tiny turtle coming toward him. Now I remember how he caught it after the camera snapped, how he held it gently in his hands, showed it to our kids, stroked its shell, his forefinger moving over the scaly dome, how he held the animal out toward me, a love offering. I took it, and together we sent it back to the sea. □

HOW PRACTICAL IS ROMANCE when choosing a lifelong mate? Can a relationship last when friendship replaces passion? Share your thoughts in our forum. Then get a global tour of love with photographer Jodi Cobb at **ngm.com/0602.**

Who will decide the fate of Russia's biggest bears?

Giants under siege

By Gleb Raygorodetsky Photographs by Steve Winter

The bear's head swings from side to side like a metronome as he lumbers across the slope. A week or two out of hibernation, he's spent the day filling his belly on the first lush greens of spring in the Valley of the Geysers on Russia's Kamchatka Peninsula. Struggling to keep his eyes open, he stumbles a few yards to the top of a knoll and crashes, resting his massive head on his front paws, and immediately nods off. The long winter over, all seems well.

Not so. A new season has arrived filled with perils for Kamchatka's brown bears, the largest in Eurasia. During the Soviet era, when I was growing up here, access to the 750-mile-long peninsula was tightly restricted by the military, and there was plenty of federal money for wildlife management. As many as 20,000 bears roamed this

Marked with
a yellow ear tag
by researchers,
a seven-foot
brown bear feeds
on salmon in
Kronotsky Reserve.

wilderness. After the Soviet Union collapsed, international trophy hunting came to the region, oil exploration and gas development and gold mining increased, and fish and wildlife poaching grew rampant. The bear population fell to about 12,500.

Today international organizations such as the Wildlife Conservation Society, for whom I work as a biologist, are helping Russian wildlife managers. But here in Russia's untamed frontier, far from Moscow's prosperity, with the local economy still in a slump, the future of the bears is up for grabs—dependent on people with different stakes in the animals. To the hunting guide the bears are a source of income. To the scientist they're a key part of Russia's wilderness. To the poacher they're competitors for salmon (and lucrative caviar). And to the reindeer herder they're wise and powerful neighbors. Whether the giants survive or fade away depends on who prevails.

Hunting Guide

The revving of snow machines outside the cabin announces their return. Victor Rebrikov strides through the door, pulling off his snowmobile goggles, raccoon-eyed from the sun and wind, aglow with sunburn and satisfaction. He's spent the day recovering the carcass of a bear shot by one of his clients, an American trophy hunter. The bear had tumbled into a gulch, and to reach it Rebrikov and two guides had rappelled down a steep slope. They'd skinned the frozen carcass and carried the heavy bearskin back out.

"Now my client will go home happy," he says, warming up with a cup of soup in the kitchen.

A former veterinarian who spent many years working in small villages across Kamchatka, Rebrikov is one of two dozen or so outfitters who organize bear hunts throughout the peninsula. The five log cabins in his camp are a short walk from Dvukhyurtochnoye Lake, more than five square miles of salmon spawning grounds wedged between two eastward fingers of the Sredinny Range, backbone of the Kamchatka Peninsula. Two thousand feet above the camp, miles of wind-packed snowdrifts blanket mountain plateaus—an ideal setting for tracking brown bears in early May as they emerge from winter dens to find fresh greens and pursue mates.

About a third of the 500 bear-hunting permits given to Rebrikov and other outfitters by the Kamchatka Department of Wildlife Management have been used in the spring for foreign trophy hunters, who pay as much as $10,000 each. In a region larger than California, with bear habitat from one end to the other, such a harvest might be sustainable. But a survey in 2002 estimated that an additional 445 bears were killed illegally that year by poachers. Researchers already report fewer older large bears.

In mid-2004 the governor of the peninsula's southern administrative region banned all spring bear hunting. (Hunting is still permitted in the fall, when the bears are harder to find.) The ban, not supported by local wildlife managers, may have been aimed at conservation-minded voters in the city of Petropavlovsk-Kamchatsky, where the majority of the peninsula's 360,000 people live. But if the ban is upheld in court, it could cause the bears more harm than good, Rebrikov warns, because outfitters won't be able to afford to keep private wardens in their hunting areas.

"If I don't have a warden or two looking after my territory, somebody's bound to start fooling around out here," he says, referring to poachers and military personnel he's run into around Dvukhyurtochnoye Lake. "And if the wardens get laid off, guess what they're going to do then," Rebrikov says, raising his arms in resignation. "The wardens will go after the bears. They have to make a living somehow."

Earlier that day at Rebrikov's camp, a gleeful Russian client posed for pictures clad in a new camouflage suit, holding a high-powered rifle next to his first bear trophy from Kamchatka. "It all happened too fast," he said. "Just after we

A brown bear snags one of two million salmon that migrate each summer to Kamchatka's Kurilskoye Lake. The largest bears in Eurasia, their numbers on this volcanic peninsula have fallen from 20,000 to 12,500, mostly due to an increase in hunting and poaching since the Soviet Union's collapse in 1991.

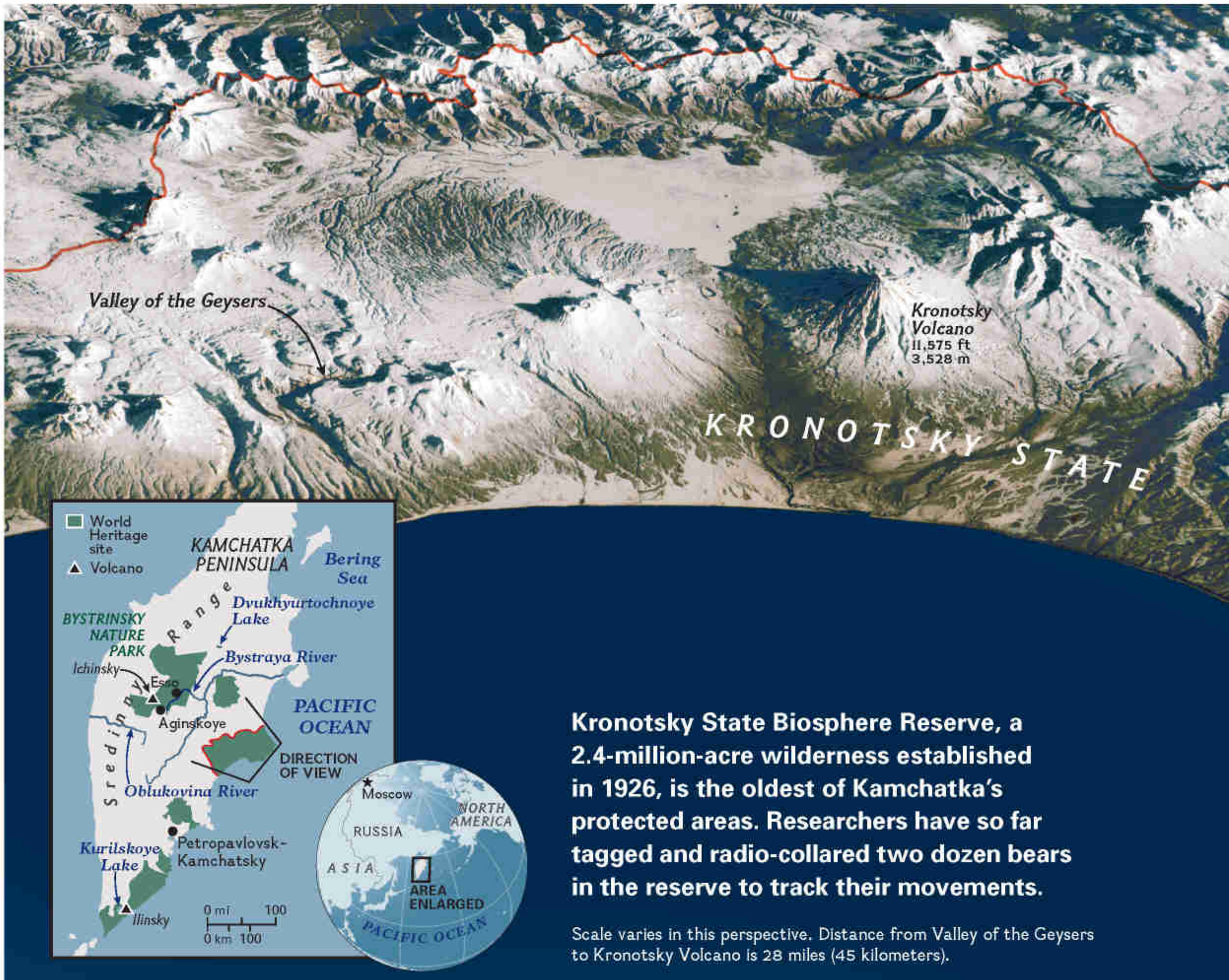


Sparring partners

In Kurilskoye Lake, roaring young bears play-fight, which



helps establish hierarchy. And what punch: Males can tower 10 feet tall and weigh over 1,200 pounds.



left camp, my driver suddenly stopped our snow machine and pointed to a bear crossing the slope a hundred yards above us. I jumped off, pulled my rifle out, and kept shooting until I ran out of bullets!"

"You're bad," the hunter's girlfriend scolded as she ran her bejeweled hand through the dead animal's fur. "You killed such a pretty bear!" She straightened and planted a kiss on the hunter's lips. The man knelt by the fallen beast, fiddling with his sunglasses as his personal assistant covered up drops of blood in the snow. What would look better, shades on or off?

A light breeze stirred the bear's silver-tipped mane. His eyes were closed, as if the king of this domain were taking a nap, stretched in the sun to soak up the long-awaited warmth of spring.

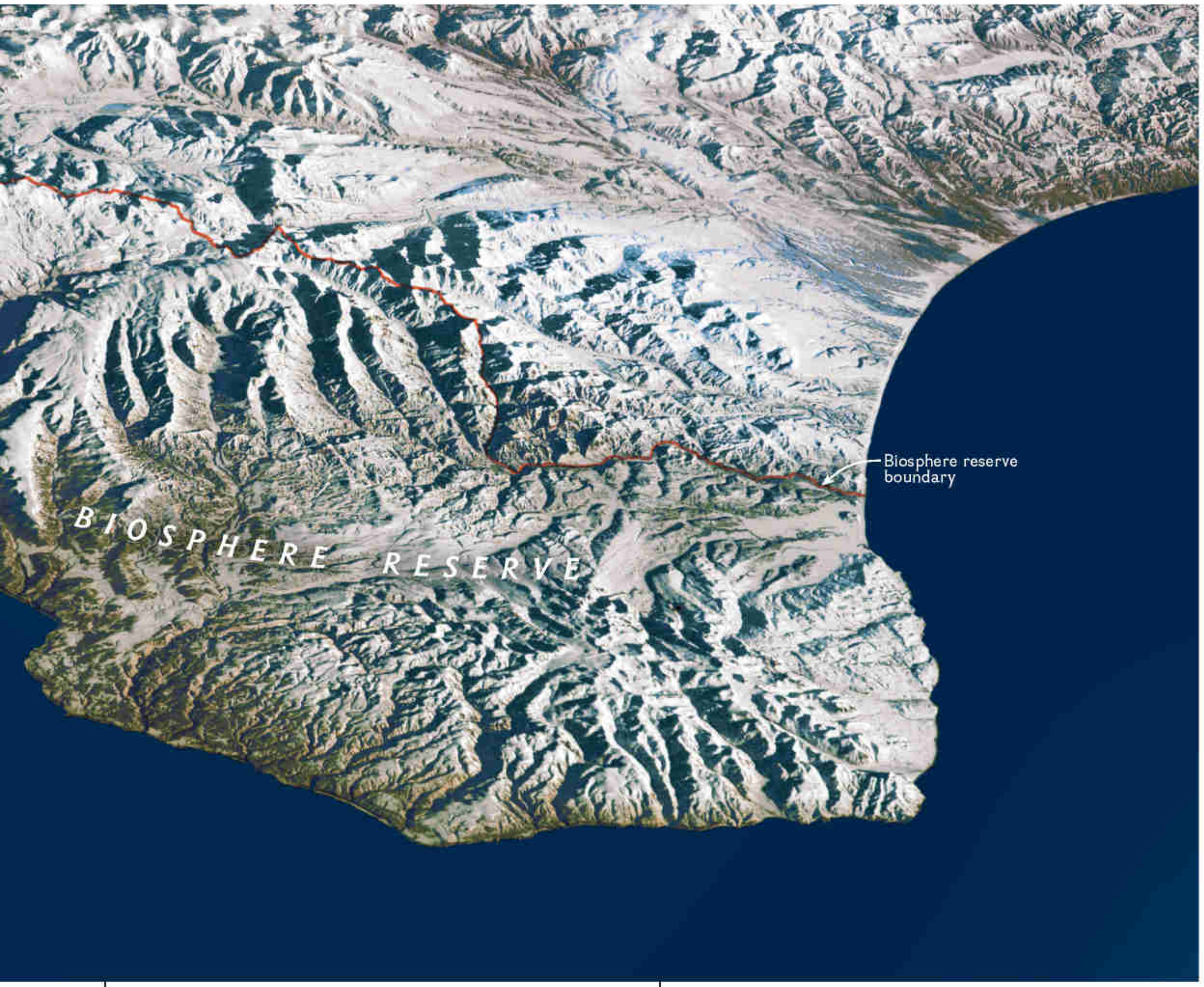
Scientist

"Shass, Aiko, down!" John Paczkowski commands, snapping his fingers and pointing at the ground. His two black-and-white Karelian bear dogs—50-pound balls of energy with pointed ears and coiled tails—freeze in mid-run and drop onto their behinds. The husky-like Karelians were originally bred in Finland to help hunters pursue bears. Paczkowski has been using them for personal protection in his bear-capture research. The dogs loyally follow him as he checks snares along bear trails at least twice a day.

Leaving the dogs behind to avoid disturbing a snared bear, Paczkowski, a Canadian biologist with the Wildlife Conservation Society, walks a little way along the bear trail to the edge of a clearing. Through binoculars he spots a dark shape moving in a grove of birch trees on the other side. "We've got a bear!" he says into a walkie-talkie, giving his colleagues at camp a heads-up to prepare for immobilizing the animal. Then he returns the dogs to camp.

Soon after, as Paczkowski and his three-man capture crew approach the snared bear, an

IMAGE SOURCE: INTERNATIONAL SPACE STATION PHOTOMOSAIC BY NASA JOHNSON SPACE CENTER. PROTECTED AREA SOURCE: UNESCO WORLD HERITAGE CENTRE
NGM MAPS



occasional whoosh escapes from the animal's nostrils, but he's calm. This one is a large boar. The wire snare, taut around his outstretched left front paw, is fastened to the base of a thick birch. After readying the dart gun, Paczkowski slowly approaches. His Russian colleague, Ivan Seriodkin, is two yards behind, a loaded shotgun pointing at the ground. Paczkowski aims the dart gun, then lowers it, takes a few more steps around the bear for a better angle and pulls the trigger. The dart hits the boar's left shoulder, delivering five milliliters of Telazol solution. Paczkowski and Seriodkin retreat and wait. Six minutes later the bear is still, and the men get to work.

Seriodkin measures the animal: seven feet from tip of nose to base of tail. Estimated weight: 600 pounds. (The largest bears in Kamchatka stand nearly 10 feet tall and weigh more than 1,200 pounds.) The boar's neck is too thick for the researchers to put a VHF radio collar on the animal as they had planned. Paczkowski attaches a bright yellow tag with an identification number to one ear and tattoos the same number inside the bear's upper lip. Then he uses a dental instrument to pry out a premolar tooth that will be sent to a lab in the United States to determine the bear's age. Information about the age of the living bears—whether they're younger or older than bears killed by hunters, for example—could help researchers determine the impact of the harvest and the effectiveness of protected areas.

After removing the snare and leather hobbles the team had put on the bear just in case, Paczkowski injects a stimulant in its neck. A few minutes later the animal moves his enormous head. The capture team can now return to the camp. In less than an hour, the bear will waddle away from the capture site, and in the evening the team will return to reset the snares.

Back at the camp, stirring a steaming pot of porridge and leftover fish for the dogs' dinner, Paczkowski talks about the research challenges.

Respect

Men of the Even, one of Kamchatka's indigenous peoples, re-create a traditional



dance honoring a dead bear. About 1,500 Even fish, hunt, and herd reindeer, but rarely kill bears.

Since the spring of 2002, when his team started working in the Kronotsky Reserve—one of the six protected wildlife areas in Kamchatka that have been designated a World Heritage site—they've equipped 24 bears with conventional VHF radio collars. But these haven't been very useful in the rugged inaccessible terrain. To get a reliable fix on a bear's location, the researchers must triangulate its position—get at least three readings of the collar's location from different directions. They've been able to do this only along a narrow band of habitat beside the riverbanks and along the ocean. Tracking bears on foot through pine brush and alder thickets is too difficult, and following them by helicopter—the only aircraft for hire in Kamchatka—is too expensive.

So Paczkowski and his team are reorganizing the project, using a new generation of radio collars with a built-in global positioning system (GPS), which automatically record the locations of the bears every hour. This eliminates the need for daily tracking. "We're hoping the data from the GPS collars will show us what we've been unable to learn from the VHF collars: the size of the bears' territories, extent of their travels, and importance of different habitat types and landscapes," Paczkowski says. How much time do they spend in berry patches and how much catching salmon? Do bears inside the protected areas wander outside? Are they affected by the growing numbers of tourists in the parks?

The scientists need better data on reproduction rates and family structure as well. Surveys in the 1990s, conducted mainly from aircraft, suggested a population growth rate of at least 15 percent, which seems encouraging, but these studies are controversial and need to be verified and updated. "Until we have a better grip on such basic, yet essential, information," Paczkowski says, "the Russians can't develop a sound management and conservation program for the bears."

Poacher

A swift current eddies around Yuri Koerkov's hip waders as he reaches into the weir, yanks out a large female chum salmon by the tail, and knocks it unconscious with a wooden club. With a few slits of a sharp knife, he separates the backbone and head from a pair of fillets and two hefty sacks of crimson roe. The head and bones go into a bucket for the dogs, the fillets into a pile for his family, and the roe into a "for sale" bucket.



"If I followed the law, I'd have to keep the tail and throw the rest back into the river," he jokes.

The government in Kamchatka regulates native hunters on the river with a heavy hand, limiting them to an annual quota of 220 pounds of salmon, a tiny fraction of what Koerkov's family and dogs need during the winter. His fish trap is hidden from helicopters carrying fisheries inspectors by the large crown of an overhanging tree. Ignoring regulations is Koerkov's way to survive, and poaching is his way of life—not only of salmon but also of everything else on the land. Trapping more than the permitted five to ten sables a year enables him to cover the cost of fuel and snowmobile repairs; stockpiling a supply of caviar, which fetches six to eight dollars a pound, provides a reasonable amount of cash; and trapping salmon helps feed his family through the winter, as does shooting a few bears.

As a native hunter, or *traditsionnik*, Koerkov holds a long-term lease to a territory where local



An American hunter bags a bear—a female, not the big male his guide thought it was. The outfitter, in white, is one of two dozen who legally guide 200 hunters a year for up to $10,000 per trip, income now at risk because of a controversial spring hunting ban.

authorities allow his family to maintain a traditional way of life. This year he and his extended family—some two dozen adults and children—arrived at their summer fishing camp on the Oblukovina River at the end of August for a two-month stay. (The river's name has been changed, as has Koerkov's.) Delayed by heavy rains and swollen rivers, they'd left the village of Esso, leading a dozen horses laden with supplies along bear trails and abandoned roads past towering Ichinsky volcano to the river's headwaters.

Koerkov and his family take wildlife mainly for subsistence. Even when they sell some, it's only to maintain their traditional way of life. In contrast, dozens of poachers—mostly from Petropavlovsk and large villages in the region—descend on the Oblukovina every summer like prospectors panning for gold, hoping to strike it rich with a small fortune in salmon roe. If they can collect enough caviar, they'll be able to buy a car or even an apartment.

Despite upbeat reports by authorities about apprehending scores of poachers and confiscating tons of caviar each year, the tributaries of most major waterways in Kamchatka are littered with cut-up salmon carcasses. Taking their business to extremes, some poachers even hire huge Mi-8 Russian helicopters, at $1,400 an hour, to ferry up to three tons of caviar out of the wilderness to the nearest road. One helicopter load of caviar, worth at least $40,000 at a local market, represents about 90 tons of salmon caught, slit, and discarded. The meat is too cheap to sell or fly out.

Brown bears also hunt salmon here. "They come up the creek once in a while, but they aren't a big nuisance to us," says Koerkov, throwing another quivering fish on the cutting board. "We keep this place clean, and there's enough fish for the bears. We just let each other be, if we can."

But downstream from his camp, salmon poachers set neck snares for bears that destroy nets getting to fish, their main food at this time of year. Such bear kills probably account for most of the illegal harvest. "Often the poachers just take the paws and gall bladders and dump the rest," he says.

Reindeer Herder

Inside the smoke-filled cooking tent Liuba Adukanova is frying *lepeshki*, small flatbreads, while cutting meat from a young reindeer steer, killed for food last evening. Tossing a couple of dry branches on the fire, she repositions the crackling frying pan and flips the flatbread golden side up. Then she slices meat off the reindeer's backbone to get to the long sinews she will later dry, pound into separate fibers, and weave into threads to sew clothes and footwear for her husband and sons.

Her niece, Dasha, slips on a pair of reindeer boots and goes to fetch water from a creek. Bearskin soles keep these boots from slipping on ice and snow, and they're tough enough to last through a year of traveling over the steep terrain where Liuba's husband, Kiriak, herds 2,000 head of reindeer. Liuba looks up from her work.

Trophy shot

Skulls and skins, once boiled and cleaned, will adorn a hunter's home.



Russians and foreigners legally kill some 330 bears a year, but a larger number probably are poached.

"Check if you can see the herd," she says. Kiriak had been due to arrive two hours ago with the reindeer. Dasha returns and pours fresh water into a simmering pot of reindeer soup. Still no sign of the herd.

An hour later, Liuba's 19-year-old son, Ilia, who's been working outside, sticks his head inside the tent and grunts, "They're here."

The clicking of reindeer hooves fills the air as the herd moves toward the edge of a clearing. There, before the onset of the rut in a couple of weeks, Kiriak Adukanov and his men will wrap up a season of castrating bulls and cutting off antlers. Wearing a tattered jacket of faded canvas, with a lasso and a pair of binoculars over his shoulder, Adukanov, who is 53, has the weathered face of a 70-year-old. He is the leader of a small group of reindeer herders who belong to a people known as the Even and who roam the valleys and plateaus of Bystrinsky Nature Park in central Kamchatka.

"The national symbol paid us a visit last night," Adukanov says. In the Even way, he does not name the bear out of reverence for the natural world. To the Even the brown bear is a sometimes kind, sometimes wrathful neighbor, ever aware of humankind's transgressions—and a formidable predator to be reckoned with.

"It took us a while to figure out what happened and find the steer's remains," he says. The bear had apparently stalked the reindeer through the tall grass to deliver a lethal blow. Then it ate half the animal on the spot. It must have still been working on the carcass when the herders approached, because the remains were lying in the open, not covered with a pile of branches and dirt the way bears normally cache their kills for a later meal. Adukanov decided not to chase the bear but to keep pushing his herd toward camp.

"It's unusual to have these problems now," he says. "In the spring we may lose one or two calves or weaklings to bears. But in the late summer and fall there's usually plenty of food for the bears. This year has been poor for berries and pine nuts, and the salmon run's not good either."

Two months ago while walking with his reindeer, Adukanov was charged by a bear, which he shot just before it reached him. The bear's meat ended up in a cooking pot for the dogs, except for the gall bladder, which was dried as a medicinal aid to treat stomach ailments. Nomadic herders like Adukanov are often blamed by

With claws like four-inch fishing hooks, a hungry bear faces only one limit when catching salmon: caviar poachers who kill bears that get in the way. This cross fire now poses the most dire threat to Kamchatka's giants.

local wildlife managers for poaching bears and other wildlife. But Adukanov says he tries not to kill more than a couple of bears a year, since it's hard to move from one camp to the next with an extra load of meat and skins. This fall, he says, he'll probably take just one more bear.

The next morning, Adukanov prepares to move the camp into the mountains nearer the Bystraya River Valley, where they'll spend the early winter. The higher they go, the farther they'll be from the road to the Aginskoye gold mine, which cuts straight through the heart of the herd's summer pastures. The roar of trucks hauling earth and gravel for the road's extension to a proposed nickel-copper-cobalt mine 25 miles away scatters reindeer on both sides of the road, making it difficult to pull the herd back together without losing any animals. The road also intrudes on prime bear habitat, as do gas pipelines elsewhere on the peninsula—a potential threat to all the animals.

Getting his reindeer through the winter is a matter of survival for Adukanov and his family. A time of howling blizzards, towering snowdrifts, and razor-sharp snow crust, it's also the season to mend boots with new bearskin soles—and to tell stories about bears.

One tale is about a mighty hunter named Torgani, who lived long ago. Torgani killed Nakat, his twin brother bear. And as the animal lay dying, it spoke to him: "You bettered me, Torgani. Fulfill my wish, lay me respectfully to rest. Organize an *urkachak,* a celebration for all people to partake of my flesh. Then your people will always have plenty of bears around."

Will Nakat's promise hold true? The answer lies in the bear's unfolding relationship with the people of Kamchatka—not only Torgani's descendants, the herders and the native hunters, but also the trophy hunters and poachers and the scientists who struggle to control its fate. □

TOOTH AND CLAW Experience the Sights & Sounds of Kamchatka's brown bears with photographer Steve Winter. Then see these powerful giants in action and browse a portfolio of online-exclusive images at **ngm.com/0602.**



A Faith Grows in Brooklyn

Lubavitch Jews spread their message as never before.



A candlelit hall leads to separate entrances for men and women who come to visit the grave of Menachem Mendel Schneerson. The charismatic rebbe—Yiddish for teacher—launched a global effort to rekindle observant Judaism.

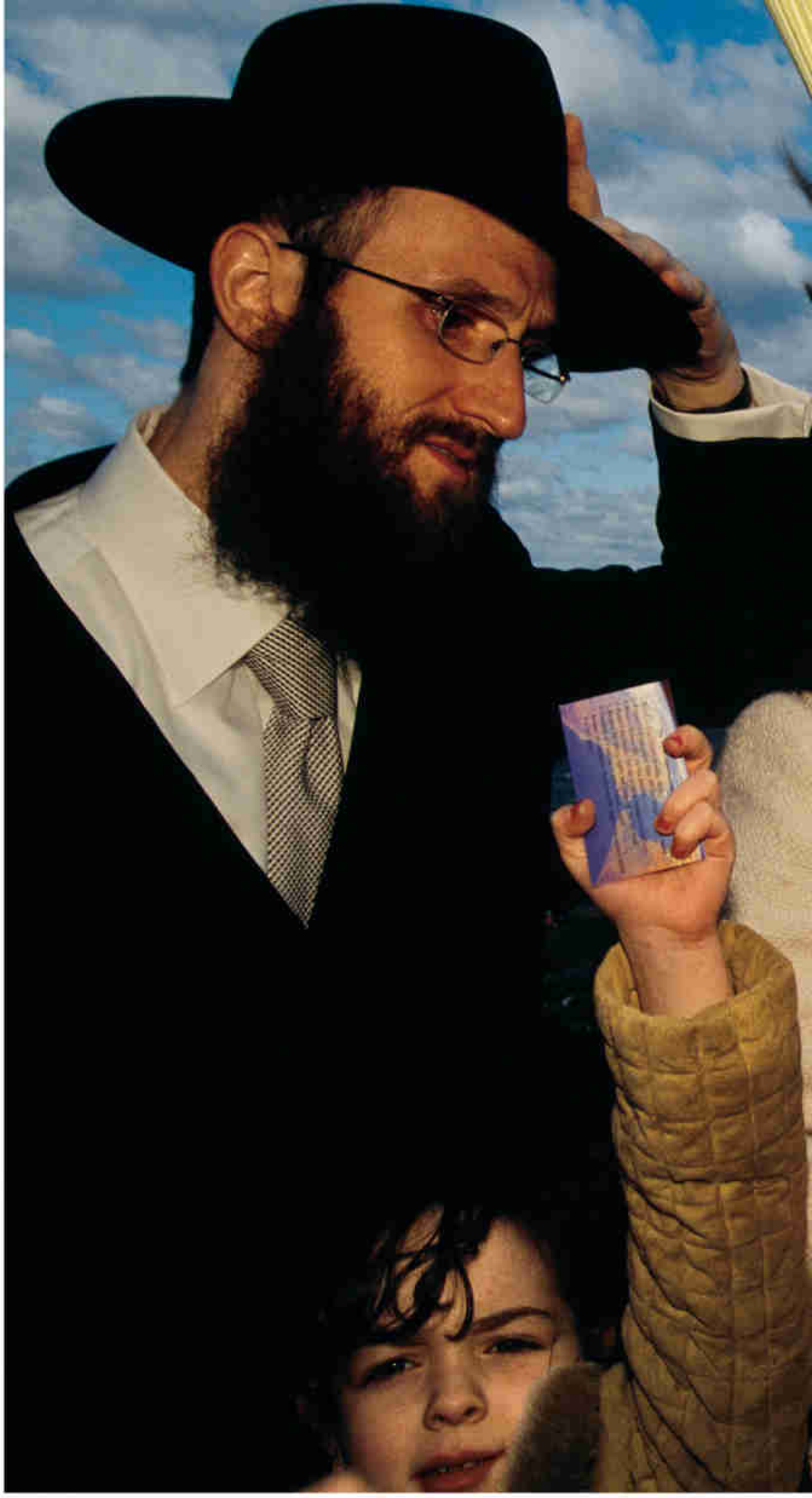
Text and photographs by Carolyn Drake

To outsiders, Chabad-Lubavitch Jews with their black fedoras and symbolic trappings can look very strange. But for onetime outsider Sheila Bar-Levav, they changed her life.

Raised Catholic, Bar-Levav converted to Judaism, her husband's religion. She enrolled their children in a preschool in New York run by Lubavitch Rabbi Aaron Raskin and his wife, Shternie. Because of their influence, Bar-Levav and her husband are now observant Jews—a transformation that embodies the Raskins' life's work. Believing that a holier world will hasten the Messiah's coming, Rabbi Raskin speaks passionately about bringing Jews back to their faith: "We have to renew that spark."

The late Lubavitch rebbe Menachem Mendel Schneerson lit that fuse for thousands. A small, vocal faction of Lubavitchers believe that Schneerson is the Messiah and revere him as such. But most simply honor the memory of the man who helped energize a religion devastated by Hitler and Stalin.

Born in Ukraine in 1902, Schneerson arrived in the United States in 1941, devout and driven. He belonged to the Orthodox Chabad-Lubavitch group—Chabad from the Hebrew words for wisdom, comprehension, and knowledge; Lubavitch for the Russian town where



the movement was based in the late 1700s.

Now headquartered in Crown Heights, Brooklyn, the group was relatively small and little known when Schneerson became rebbe in 1951. During his 43-year tenure he pioneered a system of *shluchim,* or emissaries, charged with going out into the world to open Chabad centers, spreading knowledge of the Torah and Judaism. Some feared that the Lubavitch movement would dwindle after the rebbe's death in 1994. But today there are more than 3,000 centers in 70 countries—nearly half of them founded after Schneerson's death.

Like all religious groups, this one has its detractors, its dropouts, its dark episodes. Schneerson sparked enormous controversy in his day. He supported a strict interpretation of the Torah, preaching that only those born to a

Global Movement





Reaching Out *Sheila Bar-Levav, at right, learns about symbols of Sukkot, a festival celebrating Jewish unity, from Rabbi Aaron Raskin and his wife, Shternie. As Lubavitch emissaries, the Raskins encourage Jews to practice the faith. Says the rabbi, "We are all part of one large family."*

Jewish mother or converted by Orthodox rabbis could earn Israeli citizenship—a message that outraged many Jews. In 1991 when a car in the rebbe's entourage hit and killed a black child, some members of the black community in Crown Heights became enraged, and violence erupted. Critics of the movement today deride perceived restrictions on women and the cultlike devotion of the messianic faction.

Yet Schneerson—a mesmerizing speaker whose words fill volumes—still holds a potent grip on followers. "The rebbe is here more than ever," says Raskin. "His impact is everlasting."

The faithful feel Schneerson's presence most acutely at his grave in Queens. "It has become a beacon that people flock to," says Rabbi Yehuda Krinsky, a top Lubavitch leader. The group's rapid growth attests to the power of the rebbe, who named no successor, and suggests that the Lubavitch movement is meeting the spiritual needs of many Jews eager to reconnect with their faith.

ENTER THE WORLD of Chabad-Lubavitch Jews with photographer Carolyn Drake in a multimedia show and learn more about this movement at **ngm.com/0602.**



Holy Ground *In the Old Montefiore Cemetery in Queens, the grave of Rebbe Schneerson lies to the left of the grave of his father-in-law and predecessor. Hundreds of people come every day to this place, which many believe holds the rebbe's soul.*

They blanket the site with written prayers and requests for guidance or blessings. "We believe that the soul never dies," says Rabbi Yehuda Krinsky, a high-level Lubavitch leader. "There remains an accessibility, not just in memories, but in fact."

A Woman's Work

Lubavitch mothers tend their youngest on the women's side of a little boy's birthday party in Crown Heights. Across the room their husbands engage in animated debate. "It made our heads turn, definitely," says Chaya Sasonkin (standing with infant). Lubavitch men and women often remain separate at such social gatherings. "We set very clear boundaries," says Sasonkin. "It's in the spirit of modesty."

That spirit infuses the faith. Girls and women always dress with knees and elbows covered, and married women wear wigs or shawls over their hair. "We keep what's precious hidden," says Sasonkin. "There's a sense of respect, of sacredness, about women."

Not yet required to hide their hair, girls at the Machon Chana yeshiva school in Crown Heights (below) get ready for Shabbat, the weekly day of rest and prayer. Rebbe Schneerson promoted such religious schools to give girls raised in secular homes knowledge of the Torah. As "lamplighters of Jewish souls," he wrote, women must teach their children about God. Sasonkin, a 33-year-old mother of seven, takes the role seriously: "It's the mother who says the morning prayers, who teaches the blessings, who shapes the values at home."

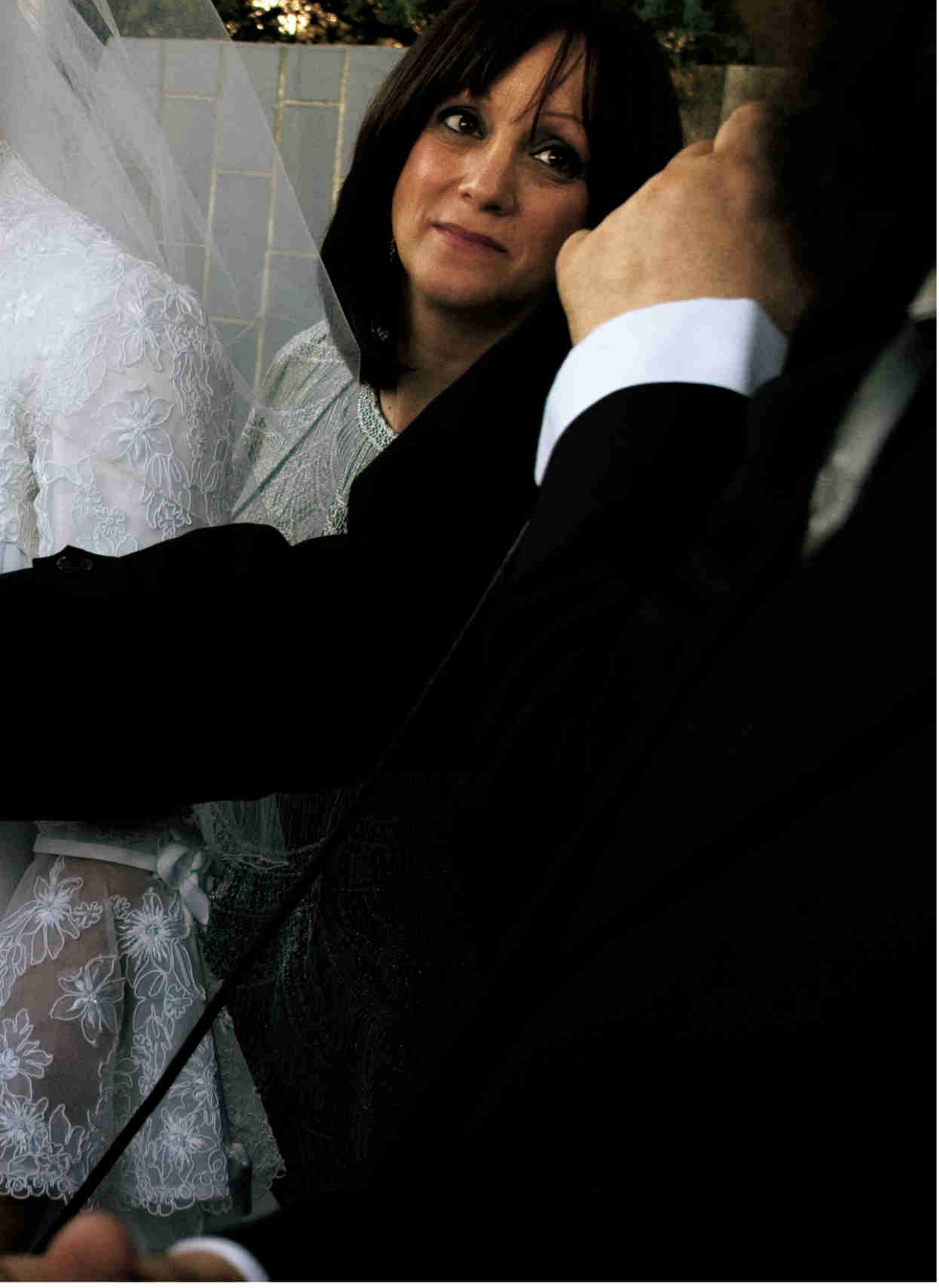




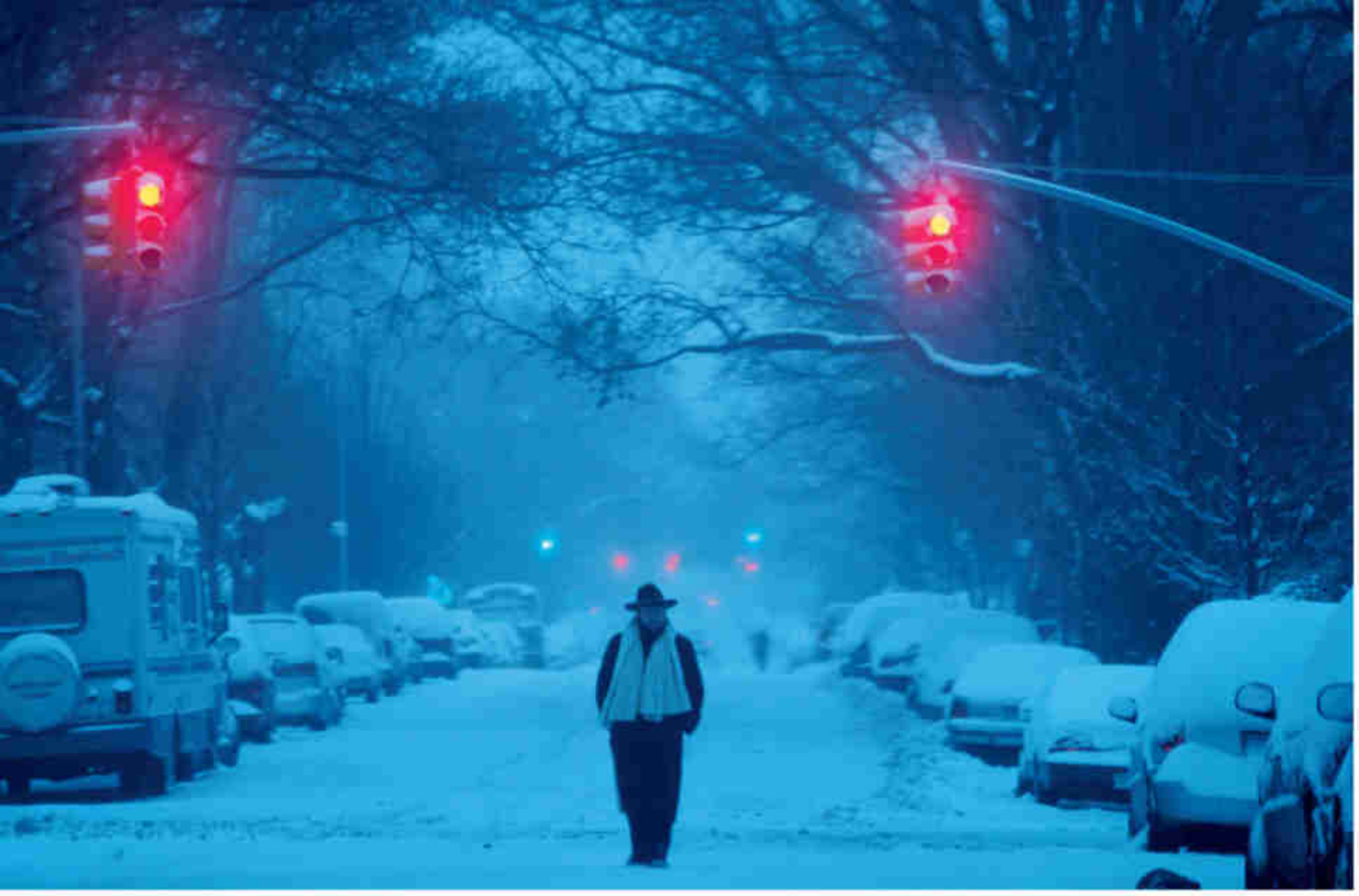


In the Torah
women are called
akeret ha-bayit, the foundation of the home.
That doesn't mean washing dishes. It's educating
our children in everything we think about life.
That's the nature of what a mother is. —Chaya Sasonkin

Bound by Belief *Chana and Dovid Zaklikowski exchange vows, their mothers by their sides. "I wanted a Lubavitch boy," says Chana, who at age 21 called friends and matchmakers to arrange meetings. The couple met through*



a friend, dated, sought the rebbe's blessing at his gravesite, and wed. To feel close to his "spiritual father," Dovid wore the rebbe's tattered jacket; Chana veiled her face with his wife's handkerchief. "We hope to be like his children," says Dovid, "to follow his ways and emulate his teachings."



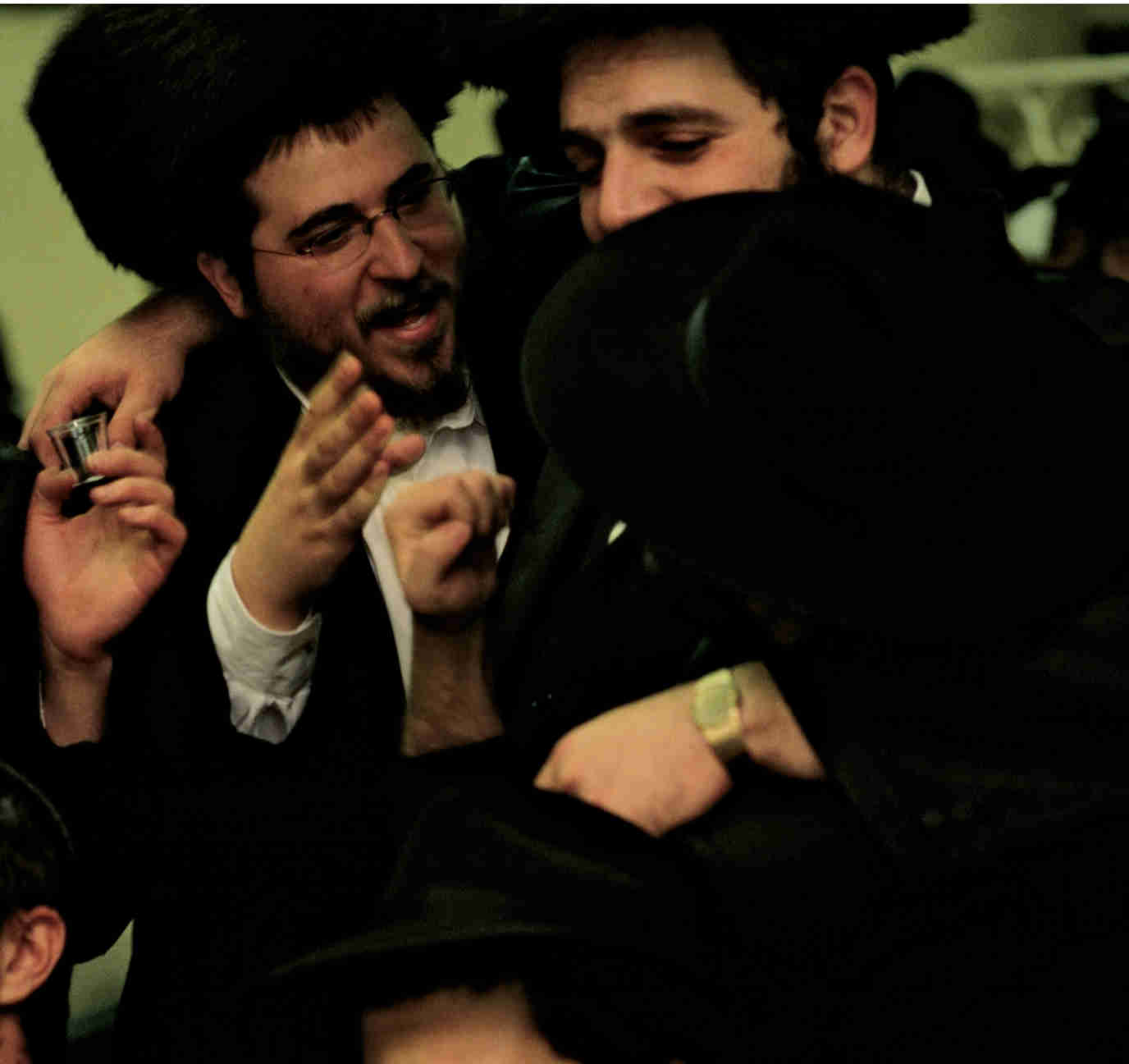
The Rebbe's Foot Soldiers

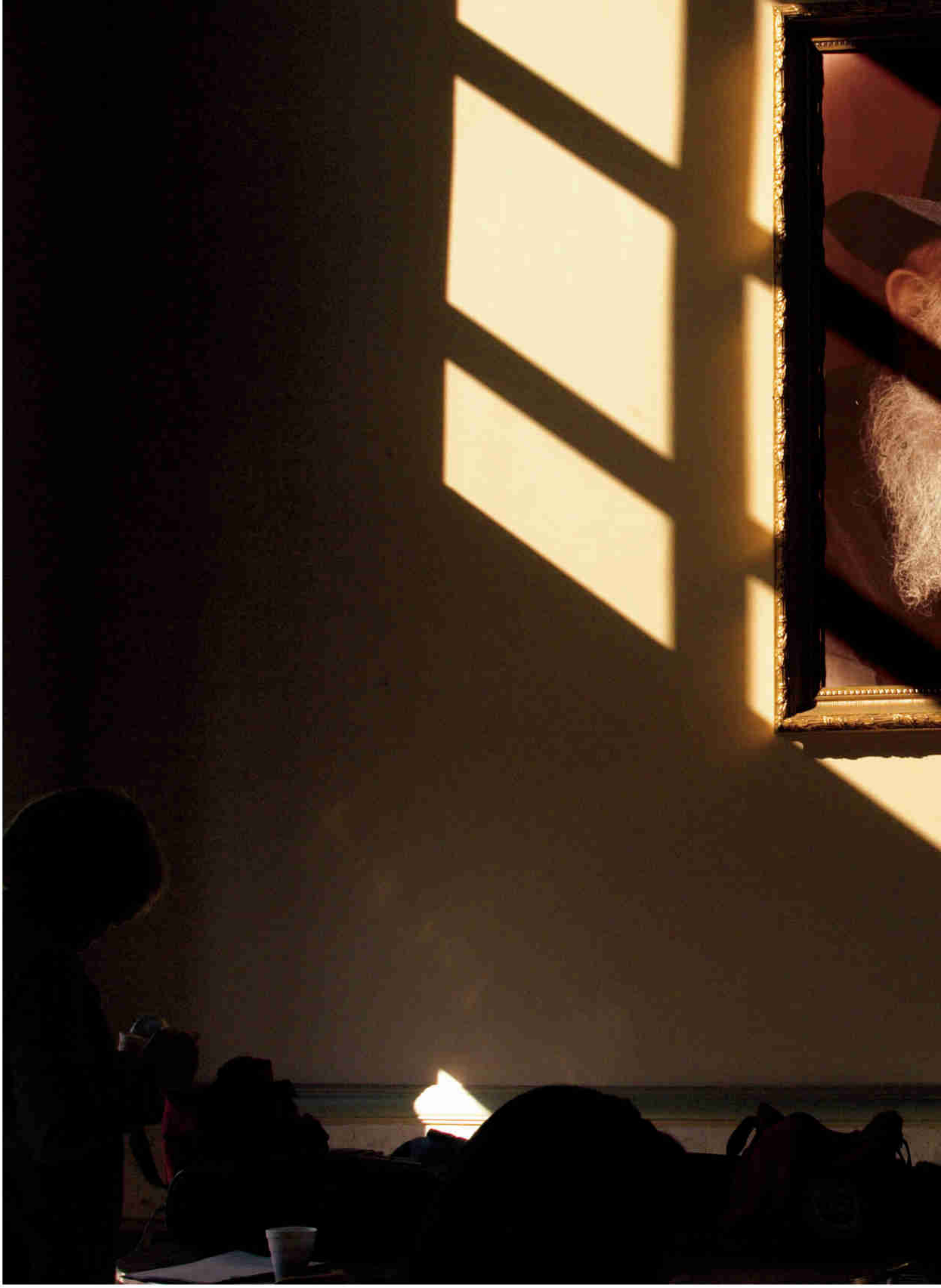
Spirits rise at an engagement party in Crown Heights (right), where men of various Hasidic groups swap their distinctive hats to symbolize unity. "We have differences in our customs and in some of our philosophies and ideas," says Asher Federman, at center in glasses, "but we are all Jewish." Raised as a Lubavitcher in California, Federman studied the Torah, married, became an emissary, and with his wife, Henya, opened a Chabad center in St. Thomas, Virgin Islands. "The biggest milestone in the Lubavitch community," he says, "is when a new couple goes to a community where Jewish awareness is not so strong."

It's tough to follow Lubavitch customs in a place with a small Jewish presence. St. Thomas, for instance, doesn't yet have a mikvah—a special bath for ritual purification—so after menstruation, women must use the sea or fly to the mainland. Lubavitch men also immerse in mikvahs to spiritually prepare before walking to morning prayers (above, in Crown Heights). Says spokesman Rabbi Zalman Shmotkin, "Even the mundane things we do, from how we walk in the street to how we interact with others, are meant to be infused with holiness."



We say *l'chaim*,
to life, with a little
vodka or wine so we can become elevated,
get beyond our differences, and reach the essence
of where we are all one. True and ultimate service to
God is with joy and with happiness. —Asher Federman





Eternal Presence *Women emissaries from around the world gather for a conference held at the Oholei Torah school in Crown Heights, where Schneerson's portrait is omnipresent. Lubavitchers say they don't aim to proselytize or to convert,*



but to educate. "Too many Jews just don't know about their heritage," says Chaya Sasonkin, an emissary in New York. "We are trying to give them what is rightfully theirs. It's not about being 'holier than thou.' We're trying to bring godliness down to this world." □

Santa Cruz Island buckwheat flourishes again after decades of destruction by feral sheep and pigs left over from ranching days. Now owned and protected by the Nature Conservancy and the National Park Service, Santa Cruz is one of the eight Channel Islands, called the Galápagos of North America for their wealth of endemic species.

California's Wild Crusade

The state that guards its beaches and vistas still struggles to keep housing tracts and farmland from plowing under its unique wilderness.

By Virginia Morell Photographs by Tim Laman





Bent but unbroken, an ancient bristlecone pine endures in California's White Mountains. The slow-growing bristlecones, Earth's oldest known living things, can survive for 4,000 years or more and may stand long after their deaths.

Guy Wagner knows the value of a good fence. In the gated communities of Rancho Mirage—where palm trees sway against the blue sky and lawns surround the white-stuccoed houses like emerald-colored pools—he is pleased with what he doesn't see these days. A few years back he routinely found bighorn ewes and lambs munching and frolicking on the manicured parkways. "Sheep have lived here for at least the last 10,000 years," says Wagner, a biologist with the U.S. Fish and Wildlife Service. "So they think they belong here—they do belong here. But people live here now too, and they don't want the sheep on their lawns, eating their roses, falling into their swimming pools and dying."

To keep man and beast apart, the Fish and Wildlife Service helped Rancho Mirage build a high fence on the hillsides to block the animals. The sheep, endangered peninsular bighorns, had been coming down from the desert canyons to feed in the valley. Fewer than 700 remain in California.

The fence works. The sheep have reverted to a natural diet and returned to their former range, which at higher elevations ends at the line of dense vegetation: They simply won't go where they can't see mountain lions and other predators.

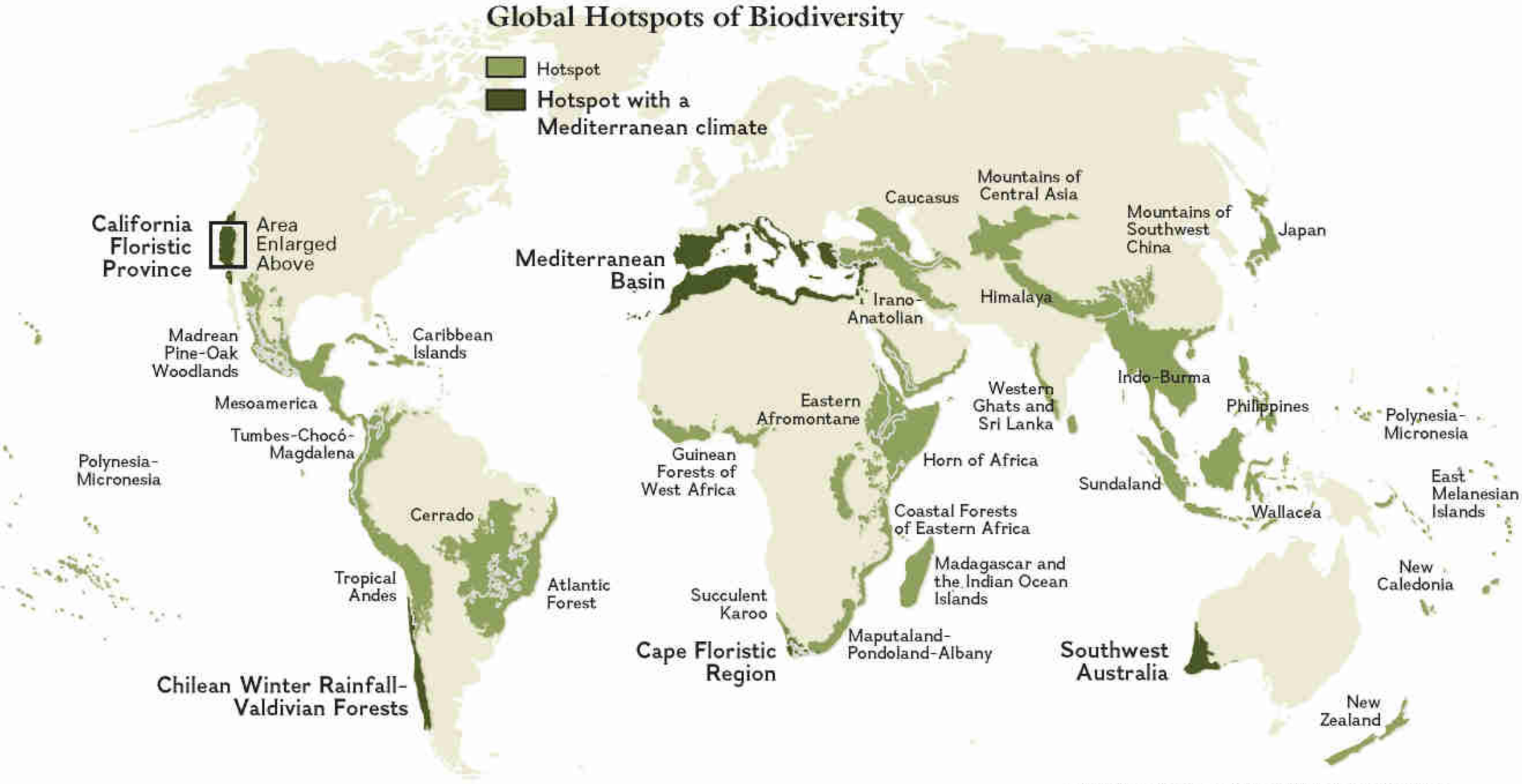
Glorious as the sheep are, the true stars of California's wilderness may be its plants—from giant sequoias and coastal redwoods to flowers setting

California Hotspot



Worlds at Risk The forests and wetlands of the California Floristic Province—an ecological zone taking in most of California and bits of Oregon and Mexico—hold flagship species like the California condor and more than 2,100 endemic plant species. Conservation International has labeled the province one of Earth's 34 hotspots of biodiversity (below), one of only five with a Mediterranean climate of hot, dry summers and cool, wet winters. Many of the province's species are threatened by agriculture and sprawl.

Global Hotspots of Biodiversity



SOURCE: CONSERVATION INTERNATIONAL; NGM MAPS

meadows ablaze to tiny, brittle plants growing in the region's infertile soils. Rocks from the Earth's mantle seldom see the sunlight. It's only in places where tectonic plates have collided, like California, that mantle rock—loaded with magnesium, iron, nickel, chromium, cobalt, but low in calcium—has been squeezed to the surface. Water changes the rock to serpentinite, named for its green snakeskin pattern, which, as it weathers, breaks down into nutrient-poor soil, heavy with metals. Such soils would kill most plants.



A volunteer with the Golden Gate Raptor Observatory prepares to release a red-shouldered hawk banded for a migration study. In California these adaptable hawks thrive in urban parks, golf courses, and cemeteries. Says researcher Buzz Hull, "The species that survive are those willing to live with humans."

Yet only in the small scattered pockets of serpentine soils will you find *Streptanthus breweri*, surrounded by rocks glowing in the sun, glassy and metallic. This plant is but a rosette of grayish leaves until the spring, when it sprouts a single stem with tiny purple blossoms, gems that gave it its common name—jewelflower.

S. breweri has other tricks. To defend itself against the caterpillars of a butterfly that lays its eggs on the plant, *S. breweri* has evolved leaves edged with raised orange dots—fake eggs, designed to fool the butterflies into thinking another butterfly got there first.

"That's what California's biodiversity is all about," says ecologist Susan Harrison. "Small things giving rise to other small things." Harrison works with state agencies and local groups to encourage the setting aside of serpentine-rich lands. In public talks she stresses the rarity of these plants and how, because many are new species, they offer scientists a "natural laboratory of evolution"—a way to investigate how biodiversity comes about.

Much of the state is so distinctive, in fact, that scientists dubbed it (with apologies to Oregon and Mexico, which contribute parcels) the California Floristic Province. With a Mediterranean climate, geology as mixed as fruitcake, and isolation behind the Sierra Nevada to the east, the province yields a remarkable floral abundance. Of its 3,488 native plant species, 60 percent can be found nowhere else on Earth. The count of endemic animals pales by comparison: reptiles, 4 species; birds, 8; freshwater fish, 15; mammals, 18; amphibians, 25. But endemic insect species number in the thousands.

The trouble with small things is that they are easy to ignore. If the big things get hammered (96 percent of the old-growth redwood forests have been cut, though most of the remaining stands are protected), what hope is there for the small ones? How do you convince people—especially those living in regions of highly diverse and threatened species—about the importance of saving the shrinking store of life?

In 1989 the Washington, D.C.-based organization Conservation International (CI) turned to the idea of biodiversity hotspots. To earn the label, regions had to support at least 1,500 endemic plant species and to have lost 70 percent of their primary habitat. The bad news: The California Floristic Province made the list in 1990.



"The original list had ten hotspots," says Michael Hoffmann, a biologist with CI. "Now we're up to 34. We've recently recognized that Japan has a diverse flora, and the Ethiopian Highlands also needed to be on the list because of its rare Afromontane habitats and species."

The hotspot approach exerts a strong influence in setting global conservation priorities, focusing public attention and strengthening the resolve of governments. It has helped attract an estimated 750 million dollars to the conservation cause, according to CI.

CI's hotspots often, though not always, overlap with regions selected by other groups for targeted effort, including the 218 Endemic Bird Areas defined by BirdLife International and the Global 200 Ecoregions defined by the World Wildlife Fund. Conservationists are working to increase the overlap and avoid missing important regions, recognizing that the best way to save threatened species is to protect the places where they live.

Identifying irreplaceable habitats and the species they hold is one thing; protecting them is another. On the ground, conservationists run headlong into questions of local politics, economic stability, and human need.

"We haven't focused our efforts on the hotspots in developed countries, although we believe such areas are truly important," says Hoffmann. "We've chosen to work in developing countries. We'd like to think that developed countries would take care of their hotspots themselves."

The California Floristic Province faces grave threats, as do four other hotspots with a Mediterranean climate (hot, dry summers and cool, wet winters)—parts of Chile, Australia, and South Africa, and, not surprisingly, the Mediterranean basin. The reason? "They're all beautiful places with wonderful climates, and people want to live in them," says Rebecca Shaw of the Nature Conservancy in San Francisco. "So all these regions tend to face the same problems: fragmentation of habitats, urbanization, and the expansion of agriculture."

California alone, already the most populous state in the country, expects ten million new residents in the next 25 years. "Planning for growth is truly our biggest problem," says Shaw. "Yet, unlike some other regions, there is high awareness about how important environmental protection is, from the people to the legislature."

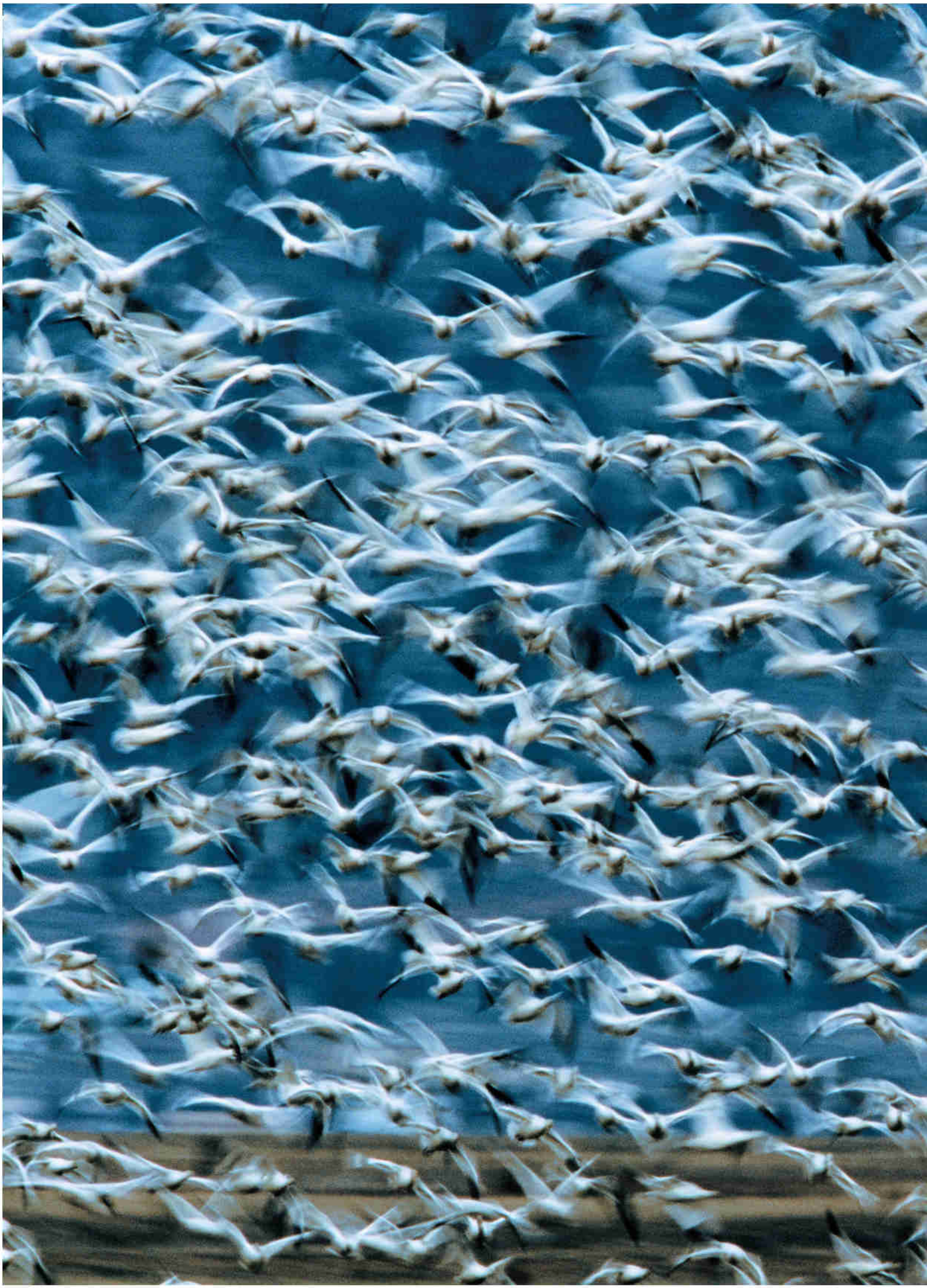
California has protected 20 percent of its land—a percentage second only to Alaska. The catch: Most reserves are set aside based on scenic values (in high elevations) and lowest economic impact, not on saving the most biodiversity. In fact, only a tiny percentage of the areas where California's hotspot species live is protected.

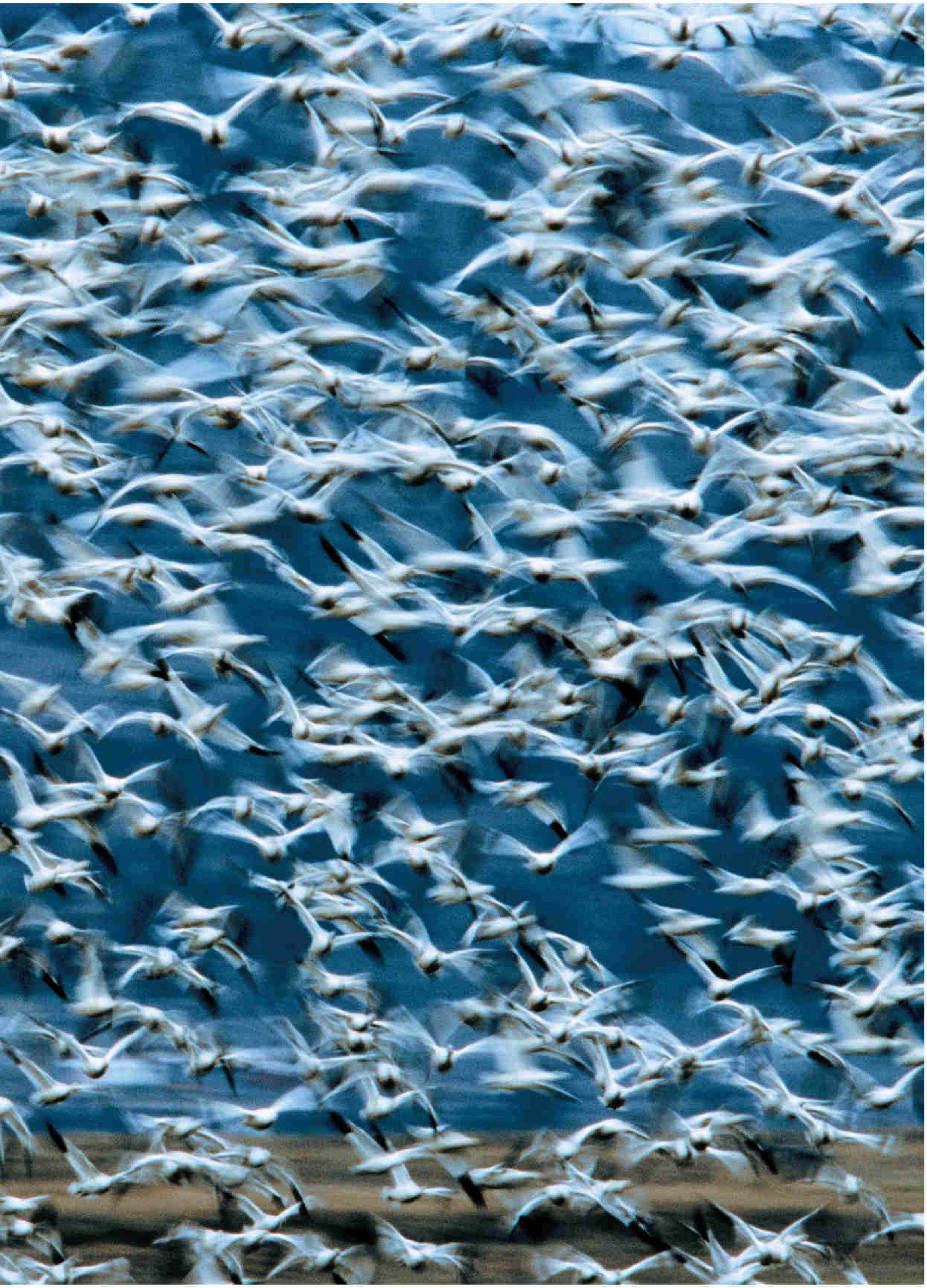
Above the lush hedges of Rancho Mirage, bighorn sheep continue to turn back at the sight of the fence. But Guy Wagner knows the fence alone will not save this population of sheep. Housing and golf course developments continue to chip away at the valley floor, as do homes and hiking and riding trails in the mountains. "We're pushing the sheep into a narrow band of habitat," Wagner says, "one that doesn't include enough browse for them on the alluvial fans or escape routes up the slopes. Will they survive? It's going to take some tough choices."

California sea lions doze on Goldfish Point in La Jolla. Protected since 1972, the marine mammals number over 200,000, with the population growing about 6 percent a year. Preying on fish, the sea lions stress the ecosystem and compete with local fisheries, raising questions about their optimal numbers.

Following pages
A blizzard of snow geese and Ross's geese sweeps over the marshes of the Lower Klamath National Wildlife Refuge in northern California. The nation's first waterfowl refuge, this land was set aside in 1908 after much of the region's wetlands had been drained for farmland.

CALIFORNIA DREAMING Download free wallpaper and bring the wonders of California's hotspot to your desktop. Then browse an online-exclusive photo gallery and share your opinion on how to preserve this distinctive region in our forum at **ngm.com/0602**.







On Santa Cruz Island (above), candleholder live-forevers stick out from a canyon wall, increasing their chances of being pollinated. "Sheep found these succulent plants very tasty, and they declined," says botanist Steve Junak. "Now that the sheep are all gone, the live-forevers have rebounded." It's a different story in California's Prairie Creek Redwoods State Park (right), where botanist Steve Sillett scales a 325-foot giant to check sensors that measure microclimates in the tree's crown. "Old-growth redwoods were so heavily logged by the 1970s that less than five percent of them are left," he says, "and only one percent of the really tall ones."



They may look like snakes poised to strike, but cobra lilies are passive killers. These carnivorous pitcher plants grow in soil called, fittingly enough, serpentine. Inhospitable to most plants, serpentine soil is loaded with metals and lacks nutrients. The cobra lily compensates by luring insects into its reservoir with nectar, then digesting the victims, a vital source of phosphorus and nitrogen.





Winter home to nearly a million waterfowl, the Sacramento National Wildlife Refuge in California's immense Central Valley offers sanctuary along the Pacific flyway between Mexico and Alaska. Yet farms and cities have gobbled up nearly all the valley's wetlands, essential for sustaining diverse animal life. The state's agreeable weather and attractive geography have promoted a seemingly endless influx of people, making habitat protection an increasingly difficult enterprise. □





HOT STUFF Fashions are hot and so is the sun at a lift line in St. Moritz, Switzerland—self-proclaimed birthplace of winter tourism in the Alps. Temperatures in the region are rising, up several degrees since 1900, a trend threatening winter sports and a way of life.

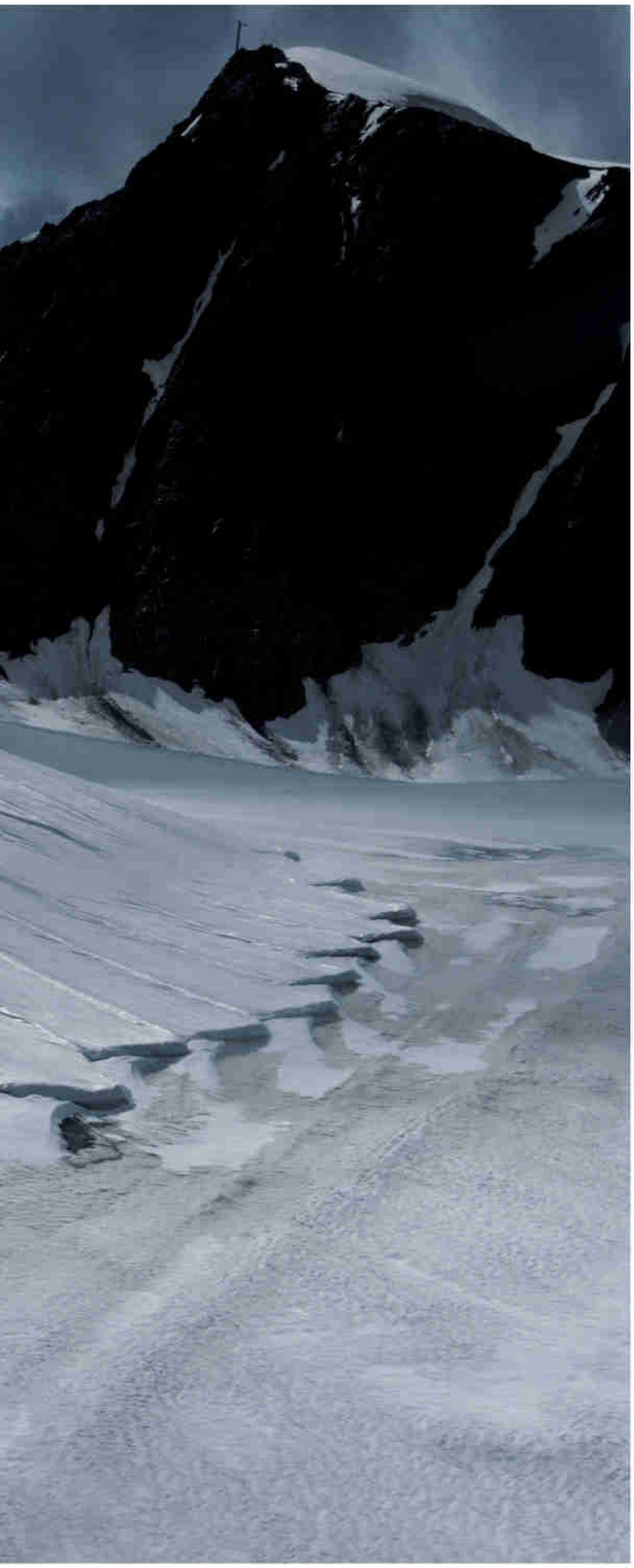
TOURISM AND COMMERCE ARE TAKING A HEAVY TOLL ON EUROPE'S WINTER PLAYGROUND—AND GLOBAL WARMING IS HEATING IT ALL UP.

Meltdown

THE ALPS UNDER PRESSURE



ICE BLANKETS **Draping a ski slope on Austria's Pitztal Glacier, synthetic blankets reflect solar radiation to slow summer melting. Such drastic measures to save the slopes may prove futile. If current temperature trends hold, 50 to 80 percent of remaining Alpine glacier ice could vanish by 2100. The loss would alter the region's ecosystems—not to mention its economy.**



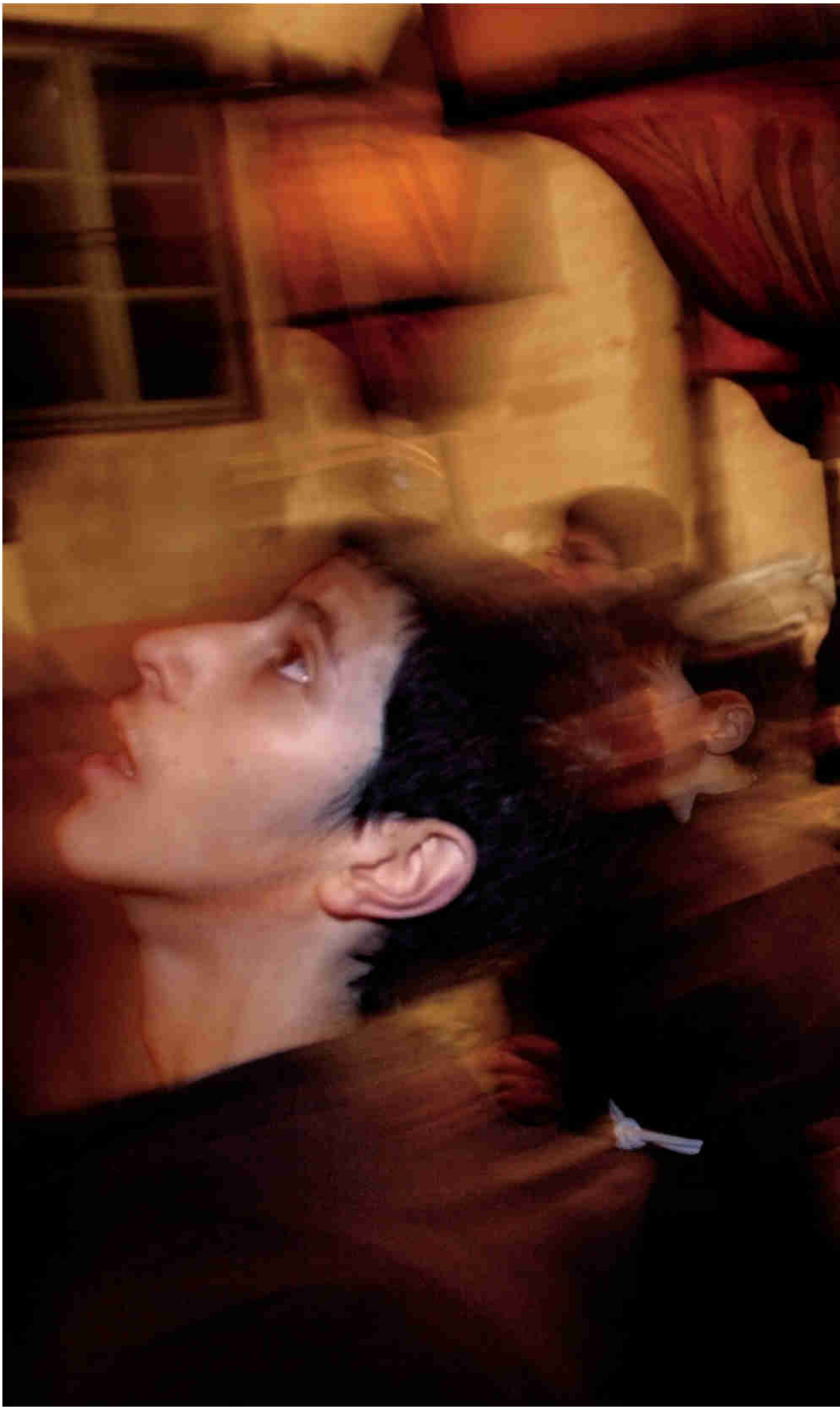
BY ERLA ZWINGLE
PHOTOGRAPHS BY MELISSA FARLOW AND RANDY OLSON

Around mid-June the Pitztal Glacier in Austria goes on summer vacation. That is to say, it begins to melt, racing down Tyrolean mountainsides in frigid streams that eventually lose themselves, like Europeans in August, at a beach somewhere. But if you are the owner of a ski resort on a glacier, four months of melting is a major cause for concern. So one day the owners of the Pitztal Glacier ski resort decided to try something radical. They ordered a supply of what are basically huge white blankets and spread them across 15 acres of the glacier to keep it cold through the summer. It seems to be working: The melting has slowed. So now ski areas in Germany and Switzerland are also wrapping at least part of their glaciers. The glaciers may not feel better, but the resort owners certainly do.

One July morning I went up the Stubai Glacier with glaciologist Andrea Fischer and her team of students from the University of Innsbruck. They were there to give the glacier its weekly checkup, measuring how much it had melted under the various types of protective fabric—large squares of wool, hemp, plastic, and combinations of these that lay in rows across the slushy ice.

One experimental square, made of plastic, had dropped almost a foot in a week. "It's quite normal that glaciers are gaining or losing mass," Fischer said. What's not normal, say climatologists, is how fast it's happening today. Fischer and her students made note of which material had slowed the melting most effectively. Various materials, including a new white fleece, had slowed the melting to an impressive two inches.

You can't wrap a whole mountain range in a blanket. But with so much riding on Alpine ice and snow—skiing, tourism, service industries,



FIRM FAITH With lanterns lighting their way, more than 400 children walk through the streets of



Mendrisio, Switzerland, on Good Friday to commemorate the Passion of Christ.
Many villages in the Alps observe such centuries-old Roman Catholic traditions.

and the livelihoods of probably millions of workers—it's easy to see why some people might want to. Yet it will take more than blankets to shield the Alps from the environmental and human pressures facing them today.

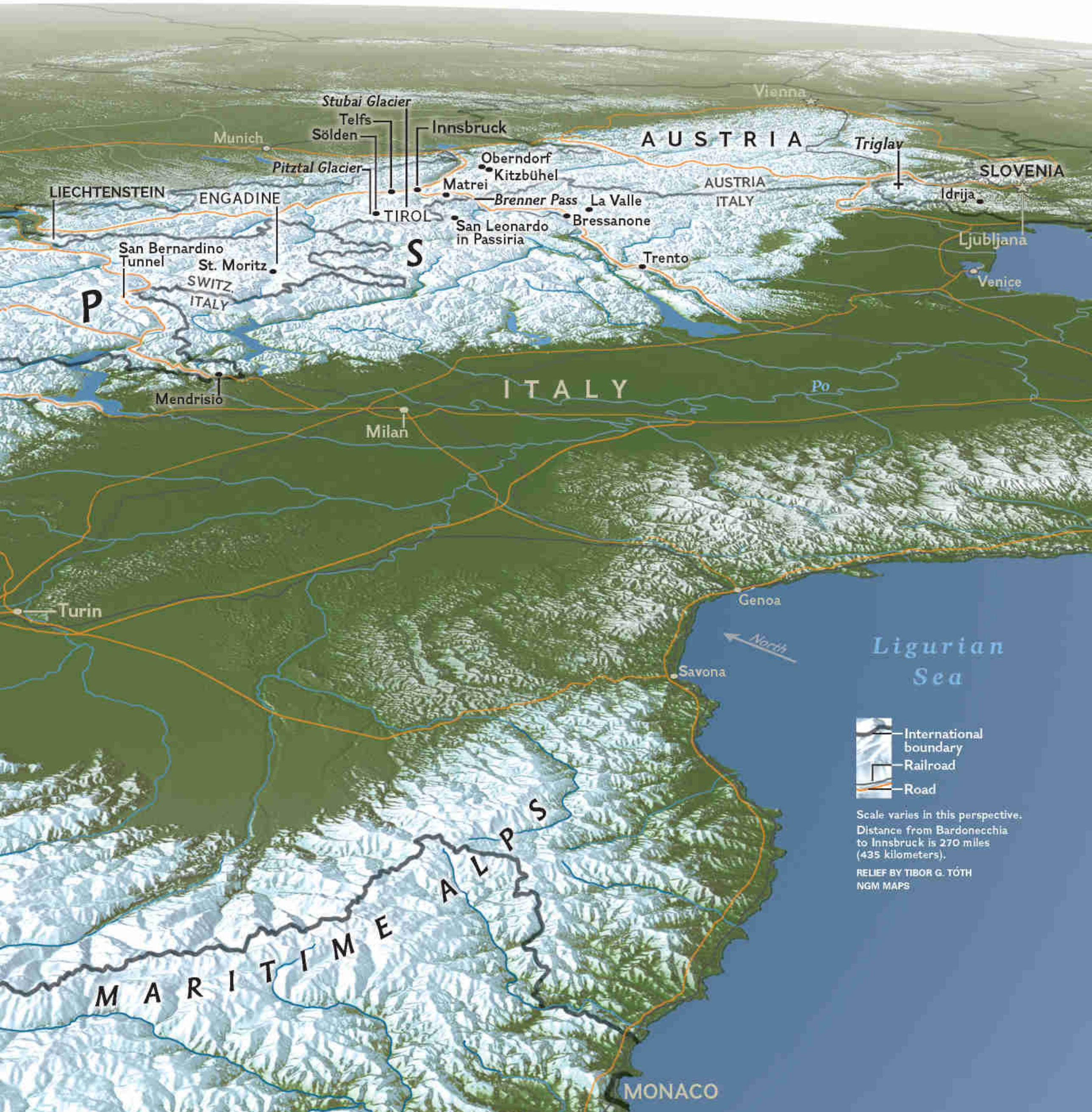
This month the Winter Olympics will unfold in the ranges outside Turin, Italy, and television will replay the old Alpine themes—Heidi, yodeling, cheese with holes in it—while focusing on vistas in which nature still appears omnipotent and largely undisturbed.

That is an illusion. Arrayed across the heart of Europe, the Alps have been intensely used for centuries, and even today only 17 percent of their 74,000 square miles are protected as parks. Their usable space is so limited that the average Alpine valley is an orgy of multitasking: factories, train tracks, hotels, houses, churches, ski lifts, farms, parking lots, lumberyards, stores, restaurants, and boutiques, all bundled together by swooping concrete parabolas of roads. And while the Alps may look empty on television, nearly 14 million people live there, two-thirds of them in urban areas and some in areas with a





GOING DOWNHILL? Skiers take to the slopes of Sestriere, Italy, site of many skiing events in the 2006 Winter Olympics. Some 600 ski resorts now dot the Alps, which stretch more than 650 miles across eight nations (map). Scientists predict that as the permanent snow line rises along with temperatures, half those resorts could close by 2050. Less ice and snow cover means less runoff to feed Europe's major rivers. And as permafrost melts, some steep slopes—and the structures built on them—become destabilized.





greater population density than the Netherlands.

But the sentimental stereotypes are hard to give up, and people almost instinctively blot out the lumber mills, construction cranes, and power lines. Andreas Goetz, executive director of the International Commission for the Protection of the Alps, recognizes this. "A lot of people come to the Alps looking for the old man with the beard, content with himself, smoking a pipe," he told me, a little ironically, in his solar-heated house in Switzerland. "We produce our chocolate and cheese and are happy all day long."

The old man is nowhere to be found. In another era Hans Gisler might have grown into the part. Instead this young Swiss sculptor left his farm in the remote mountain hamlet of Riemenstalden five years ago to seek his fortune in the prosperous small town of Altdorf, ten miles away down the valley, where he makes his living out of wood, metal, and his own talent.

Altdorf has a lot to offer: legend (it was where William Tell shot the apple off his son's head), industry (Merck pharmaceuticals), and a steady tourist business that attracts thousands of visitors a year. A number of them buy gallery pieces from local artists who, like Gisler, draw inspiration from the Alps overlooking Altdorf—blinding mountain bulwarks that seem to have been hacked out of the firmament with axes.

When I met him, Hans was preparing to carve a sculpture from the 23-foot-high trunk of a century-old sequoia, which the city had recently cut down because its spreading roots were threatening nearby houses. We stood on a hillside overlooking the town, where he had placed this gigantic piece of raw material.

"I moved to Altdorf to be closer to my customers," he explained, "but I couldn't live without the high country." If he had been born 50 years earlier, he would almost certainly have had to remain on the family farm, satisfying his artistic drive by producing utensils, souvenirs, perhaps the occasional crucifix. Today, the prosperity that tourism has brought to the Alps has given him a chance to pursue his talent and make real money, rather than merely survive at the subsistence level his ancestors had to accept. But it doesn't mean he's become a city boy in one stroke. He goes back to help his brothers when he can, especially at hay-cutting time. The sound of the scythe, he said, is "music to my body and soul."

TRAFFIC TOLL **Every day 4,000 tractor-trailers thunder through the Mont Blanc Tunnel (below) connecting France and Italy. Roads and tunnels throughout the heavily traveled Alps have allowed tourism to thrive, but they've also brought an unwelcome guest—pollution. In the town of San Leonardo in Passiria, Italy, a veil of smog fed by vehicle exhaust clouds a narrow valley (left).**



His idea for this sculpture—"the relationship between man and nature"—is no sentimental fantasy. It has always been the core reality of Alpine existence. The Alps are a realm of crushing and freezing and falling, not a world to be romanticized but one that requires respect, ingenuity, even humility. He accepts that the sequoia had to be cut down—after all, humans have been altering the Alpine landscape for at least 5,000 years. And to own a mass of wood this huge was a tremendous stroke of luck for a young sculptor. But still he moved his hand affectionately across its shaggy bark, breaking off a shard as a present for me. "I hope," he said shyly, "that the sculpture will be a kind of memory for the tree."

Increasingly, the Alps are big business. In the spa town of Évian, France, the people who bottle its mineral water send 1.6 million gallons of liquid Alps out of their plant every day. They promote their product by showing romantic snowy peaks below the simple words "Welcome to Our Factory." They're right: The Alps are a sort of factory. They produce millions of cubic meters of lumber, hundreds of thousands of tons of iron and salt, not to mention spectacular quantities of cheese, wine, and apples, athletic challenge, artistic inspiration, spiritual insight, and many forms of expensive and dangerous amusement. Mining and lumbering are down, but since the invention of winter tourism some 140 years ago, the Alps have become an enormous factory of fun.

All this has catapulted generations of isolated mountain folk into the modern era. "There are people who say, 'Oh, the old days were so beautiful,'" said Xavier Siaud, 70, who grew up on a farm near Le Perrier. "But in the old days there was poverty." Three generations ago, men routinely left their villages in the winter to make extra money traveling across Europe selling everything from blankets to flower bulbs. Today, for every grizzled farmer in lederhosen there are ten ski-lift ticket sellers, nine second-home builders, eight 40-ton-truck drivers, seven Portuguese chambermaids, six pizzamakers, and a batch of people selling postcards and disposable cameras. Adjusting to all this isn't so easy.

Consider the Tyrolean village of Sölden, once a quiet farming community, now a pounding maelstrom of hotels, bars, and shops that cater



PLAYED OUT **Finishing his shift, Anton Gantar has spent the past ten years helping seal off the mercury mine in Idrija, Slovenia. It closed in 1995 after nearly 500 years in operation. This mine gave rise to the town—and seriously contaminated the area's soil and water. In recent years new industries have moved in, keeping unemployment low.**



to skiers, who pour in by the thousands every winter from all over Europe. Perched on a slope high above the town is an old wooden mountain hut called Gampe Thaya. The Riml family, which owns a hotel in Sölden, used to stay here in the summer when they grazed their cattle in the high pastures, as everyone did in the old days. (In German, the word "alp," in fact, refers to these pastures, not the mountains themselves.)

Jakob Prantl and his wife, Daniela (née Riml), were making a reasonable living from the hotel, and from their cows, but 13 years ago they noticed that Gampe Thaya was sitting pretty much in the middle of a ski run. Voilà—a rustic restaurant was born. Jakob prepares traditional Alpine dishes using ingredients bought from local farmers along the Ötztal valley instead of the fast food skiers have come to expect. It was slow to catch on, but now he serves up to 400 people a day.

"Doing this is what I wanted," Jakob said. "We have three kids, and I wanted to show them that everything doesn't have to be quick." If it were up to him, the family would be farming full-time, but that's impossible these days. "If you have children, they have to go to school in Sölden," said Daniela, "and living there costs a lot of money." Jakob, who raises cows and builds houses from April to November, has mixed feelings about tourism. "It's all right," he said grudgingly, "if you know how to handle it." He, at least, has found a way to continue farming while taking advantage, as many others have done, of the windfall of tourism. Rather than having to choose one or the other, he and Daniela can benefit from both.

We marvel at the mountains, but it's the water that everything depends on: edelweiss, ibex, even the mountains themselves. Snow, glaciers, permafrost, surging hot springs, aquamarine ramparts of ice—the very capillaries of the rock itself are permeated with water. It comes sleeking down black rock faces, it drips into hidden cavern pools. If the Alps had a voice, it would be the musical notes of water. Water is what is literally holding the high mountains together, and if the ice and permafrost begin to lose their grip, as is already happening, the mountains start to crumble.

"High-altitude regions seem to be more sensitive to the climate warming, and the retreat of



glaciers is one sign," says Martin Beniston, a climate specialist at the University of Fribourg, Switzerland. "During Roman times it was even warmer than it is now. From Val-d'Isère to Zermatt, people could cross passes where they go glacier skiing now. But today it's the speed of warming that concerns us the most. It's very rapid." How rapid? Scientists estimate that the Alps have lost half their glacier ice in the past century, 20 percent of that since the 1980s; glaciers in Switzerland have lost a fifth of their surface area in the past 15 years.

As temperatures rise, so does the snow line. Sooner or later some ski centers will be stranded, and their towns will shrivel away. And rockfalls, only an occasional hazard in earlier times, are increasing, endangering communications towers and radio installations, not to mention the occasional human.

"What if there weren't any more skiing?" I asked Karin Thaler, a university student from Oberndorf, near Kitzbühel in Austria. She stared at me, thunderstruck. "That would be *horrible*," she stammered. "Everyone has something to do with skiing. A winter without tourists? It wouldn't be possible."

This is why the owners of the Pitztal ski resort and other sites are paying serious money to wrap their glaciers (some $121,000 a year for the Pitztal Glacier alone). They foresee a day when high-altitude glacier ski areas will be the only ones that can reasonably count on enough snow to stay open.

"We're businessmen," said Willi Krueger of the Pitztal resort, which sits above 9,000 feet. "If I were investing, I wouldn't invest in any ski area lower than 5,500 feet." Yet ski areas are still being developed throughout the Alps. And with them come roads, hotels, and ski lifts that can carry 1,800 people an hour.

Then there is the problem of snowfall. Global warming is making the snowfall less predictable. Sometimes there's a lot, sometimes too little, and it doesn't always come when you call it. Artificial snow is one of those solutions that just creates more problems. "If a resort wants people skiing in spring, it has to make the snow cover last longer," said Ulrike Petschacher of the World Wildlife Fund in Innsbruck. "But this damages the plants and disturbs the water cycle."

I had looked at a series of photographs of a mountain in the process of becoming a ski area.

LUSH LIFE **Children in designer wear (left) prepare for a charity fashion show at Badrutt's Palace Hotel in St. Moritz, Switzerland, where suites can top $2,000 a night. In Switzerland alone tourists spend some ten billion dollars a year. Vital to local economies, Alpine guests are pampered: At the Hotel Bellevue in Cogne, Italy (below), a couple relax in a milk-and-honey bath.**



It resembled those pictures of a person's face after plastic surgery, just when they take the bandages off. The scars will remain. "There's the French model called *ski total,*" explained Marco Ferrari, editor of Italy's *Meridiani Montagne,* a mountain travel magazine. "In the sixties and seventies developers would go to a place where there was just a hut and build a town where everything is included—ski slopes, discotheques, wine, massages. This has left an indelible mark on the mountains. But skiing is always invasive. Skiing is a very aggressive activity. It's aggressive to go there in your car, aggressive to go up the mountain on a ski lift. It's a tourism that's still rooted in consumerism." Or, as one Austrian historian puts it, "prostitution of the snow."

Walk the main street of Les Deux Alpes, sometimes called the Las Vegas of the Alps, at sunset on a winter day. It was constructed on a plateau that the people of two nearby villages, Vénosc and Mont de Lans, used for summer pastures. Today its trampled streets are chortling with neon signs advertising hotels, restaurants, bars, stores, and Internet cafés. The stupendous white summits resound like a trumpet fanfare above a bunch of ukuleles.

Still, is that kind of development more offensive than the more gradual suffocation of once small, traditional Alpine villages like Chamonix? "The spirit of the mountains is lost," said Roland Stieger, a mountain rescue and security expert. "It's more about trying to sell fondue Savoyard than about the mountains. There can be 100,000 people here in one day, and there are only 10,000 inhabitants. At Easter, it feels like someone put Italy, Switzerland, and England on holiday together and sent them all to Chamonix."

I climbed into the mother of all trailer trucks in Ljubljana, Slovenia, at 2 a.m. one Monday morning. Destination: Paris. I thought it would be interesting to see the Alps from the trucker's point of view, but soon discovered that his first priority is to avoid as much of the Alps as possible. To a trucker, as someone quipped, the Alps are nothing more than the world's biggest speed bump.

Twelve million trucks and about 50 million cars cross the Alps each year. From the Balkans to the North Sea, Hungary to Spain and Portugal, they roar through at least ten major tunnels and so many smaller ones that you could practically

MONEY'S NO OBJECT **Window shopping is serious sport in St. Moritz. Since the 19th century the**



Alpine town has attracted winter tourists who have money to burn. Twice a host of the Winter Olympics, St. Moritz today is one of many posh year-round resorts in the Alps.



tear the Alps on the dotted line. Seventy-seven million tons of cargo move through the mountains in an average year—furniture, chemicals, livestock, mineral water, automobiles. By 2020, some predict, trans-Alpine commercial transport will double.

The mountains concentrate the fumes and noise from all these vehicles. The emissions are trapped in narrow valleys where the wind doesn't reliably reach, and the upper layer of warmer air at night creates a cap to hold them down. Their carbon dioxide is a contributor to global warming. As for noise, the same principle that makes the deep notes of the alpenhorn resonate up and down a valley works just as well for the engines of big trucks. Their maddening buzz-saw whine can be muted horizontally by the sound barriers that have been added to many highways, but there is no way to block the sound that the valley walls echo and carry upward.

"Noise you'd barely hear on the flatland at a distance of 400 meters carries up to 2,000 meters in the mountains," said Dr. Klaus Rhomberg of Doctors for the Environment in Innsbruck. This constant undernoise raises blood pressure, shreds nerves, may increase the risk of heart attacks and strokes, and impairs children's ability to concentrate.

Standing on a bluff above Sauze d'Oulx, one of the Olympic skiing venues in Italy, gave me a great view of the valley—or rather two halves of a valley bisected by the motorway snaking toward France via the Fréjus Tunnel. I was more than 1,100 feet above the highway, and the noise of the truck traffic was just as grating, and possibly louder, than it had been all night a hundred yards away from my hotel window in Bardonecchia.

Traffic is also tiresome. In Matrei, an Austrian village near the Brenner Pass, the narrow main street is always jammed with cars making a detour through town to avoid paying the motorway toll. "Our village is very nice, but sometimes you can't cross the road because car, car, car coming," said Inge Makkawi in careful English. She and her husband were sweeping up swarms of crimson rose petals and fallen blossoms from the driveway of their pension. "Of course transport must be. We can't do without it. Do we want to go back to using a horse? Or carrying goods on our backs? I don't know. I don't know. You can't stop it."

WILD AND HOLY **In Telfs, Austria, "wild men" (left) wear suits of tree lichen during Schleicherlaufen, a festival that celebrates winter's end. Fifty-four years ago a quieter faith drew Sister Clara to the Convent of St. John in Mustair, Switzerland, begun as a monastery in the eighth century A.D. "It was pure joy," she says. "But girls today don't want to become nuns."**



Alpine people like the Makkawis are known for their stoicism, a philosophy crafted for a world of avalanches and isolation but applied now to more modern problems. I talked to a number of people living along the main highway between Germany and Italy, which runs through dozens of Austrian mountain villages on its way south to the Brenner Pass. I was prepared for outrage—and there are protest groups—but mostly I found people like Wilhelm Wagner. He was closing up his pastry shop in Matrei when I felt an urge for some of his chocolate chip ice cream. I asked if the noise from the cars outside bothered him. He smiled and shrugged. "If I complain about them," he said, "then I shouldn't use my car either."

Alf Arnold is less inclined to accept the status quo. I visited him in Altdorf, at the headquarters of his organization, the Alpine Initiative. The organization educates the public about transport issues and lobbies the Swiss government and other Alpine countries to move commercial transit from roads to rails.

Looking out Alf's office window, I could see why. The narrow streets below, in the town's old center, streamed with traffic, including the occasional heavy truck grinding south toward the St. Gotthard Tunnel to Italy. Heavy trucks are forbidden to drive through town, Alf said. But any trucker with an urgent need to avoid checkpoints on the nearby motorway—"maybe he's taken drugs so he can drive for three days on two hours of sleep, or he's got explosive chemicals concealed in his cargo, or his brakes don't work"—takes his chances in Altdorf, where the police are outnumbered and fines intermittent.

"In the referendum of 1994 the Swiss said they wanted to transfer trans-Alpine goods from road to rail within ten years—which would have been 2004," he said. "But then the government extended the deadline another five years. The EU has always wanted 40-ton trucks to go through Switzerland." The trucking lobby is as powerful in Europe as anywhere, constantly reminding legislators of how many cities encircling the Alps—Milan, Munich, Zürich, Grenoble—are crying out for cargo.

There are a few hopeful signs: In 2007 the Lötschberg Base Tunnel is due to open, followed by the Gotthard Base Tunnel in 2015, which at 35 miles will be the world's longest. Both will be exclusively rail and will shave at least an hour

TENDING OLD WAYS On land her family has worked for 150 years, Irma Costabiei rakes hay in La Valle, Italy, an area so remote that villagers still speak a language called Ladin. "I love the peace and quiet here," she says. Despite encroaching development, that peace may survive. Government subsidies and tourists sustain small farmers and their way of life.



off trips between France and Germany and Italy. A high-speed rail link between Lyon and Turin is also in the works. But these projects, as often occurs, are technological solutions to a problem that might better be resolved by changing behavior. People want to travel in cars. So on one day last August millions of Italians returning from their summer vacations brought southbound traffic to a dead stop between Bressanone and Trento—a distance of 60 miles.

With all the people, cars, and trucks swarming over the Alps, it's good to step back once in a while and remember that the mountains themselves are the main characters in this drama. They come chunking out of the flatland and sweep upward, velvety green, in parts of Swiss Engadine and French Savoy; at the Great St. Bernard Pass they're rocky and stark, mountains with their skin ripped off. Even their names—Eiger, Jungfrau, Triglav, Matterhorn—strike the heart like the names of regiments. And yet, amid the fanfare, their essence is also soft and lyrical: the polite clunk of boots knocking against wooden doorframes to loosen the trampled snow, or the mysterious mountain luster, more felt than seen, that poet Gwendolyn Brooks called "giantshine." The mountains are the central reality of Alpine life—and today they need us as much as we need them.

Léon W. Collet, an early 20th-century professor of geology at the University of Geneva, must have felt something like that. A student recalled that the professor would routinely undertake ambitious climbs in the course of his research, ascents that would paralyze the average weekend wanderer. Yet whenever he reached 13,000 feet, Collet would stop to put on a hard white collar and tie.

Was it humility? Gallantry? Superstition? Whatever it was, modern lovers of the Alps might learn something from Dr. Collet. As a geologist, he knew what the mountains were made of. But as a human being, he knew what they demanded. And he certainly didn't intend to aggravate them. ▯

THE HEAT IS ON How can the Alps be saved from diminishing snowfall and shrinking glaciers? Tell us on our forum. Then enjoy more scenes of Alpine life in a Web-exclusive gallery and download wallpaper at **ngm.com/0602.**

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LITTLE HAITI, FLORIDA



33127 Visions of Little Haiti

Last year 15 high school students in Miami's Little Haiti neighborhood attended a National Geographic photography camp where they learned to compose, shoot, and edit digital photos. Then they set out to capture the soul of their neighborhood.

BY NEIL SHEA NATIONAL GEOGRAPHIC WRITER **PHOTOGRAPHS FROM NATIONAL GEOGRAPHIC PHOTO CAMP**



Hoop dreams take flight on a homemade court as Jeanny St. Fleur (in white) sails the ball home. "The basket kept falling," says Wideline Jean, 17, who snapped the photo. But that didn't stop the game. "They'd just cry, 'Mommy, Mommy, come fix it!' "

Jean Atendien was relaxing with friends on a vacant lot when Diego Jeanty asked permission to make this portrait. Not all locals—many of whom came to Miami to escape violence and persecution in Haiti—felt as comfortable in front of the lens. "At first people were like, 'No, no, don't take my picture!' They thought we were going to do voodoo on them," Jeanty says. "We had to gain their trust."

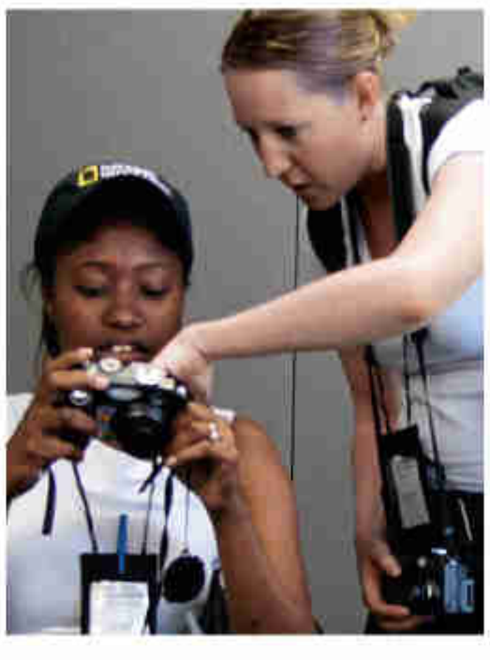






Hand-painted menus and Caribbean scenes adorn the walls at Chez Anouse, where a Haitian breakfast of *banane et foie*—plantains and liver—costs four dollars. For many Haitians, food provides links to lives left behind. Francesca Philogene framed this shot as Michel Sophie, at right, waited for a traditional dish of fried pork and rice. "She's been living here for two years," Philogene says. "She caught my eye because she was smiling and beautiful."

Not far from the lavish, throbbing party that is Miami Beach, the saints and spirits of voodoo curl through Little Haiti in whispers. The students from Edison Senior High School who attended National Geographic's photography camp (below) grew up between these worlds, and they have learned to navigate both. Their neighborhood is poor—a third of families live in poverty—and these kids can point out where the drug deals go down or where they last heard shots in the dark. But such things don't define the place for them. Their photographs reveal a bright community where neighbors chat on doorsteps, the slap of dominoes rings truer than the bang of guns, and voodoo—even if it is old school—still matters to people who journeyed here in boats, praying to spirits all the long, uncertain way. These students speak Creole, French, Spanish, and English. They want to be physicists, nurses, and artists. Most plan to build their lives here. And they want their work to show that stereotypes don't apply. "This camp helped me help Little Haiti," Diego Jeanty, 16, wrote in his photo journal. "Because now people can see what Little Haiti really is."



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Starting in March, a new NATIONAL GEOGRAPHIC feature called **Your Shot** will showcase readers' photographs. For the first three months Your Shot will feature images from photo camps like the one in Little Haiti. Beginning in June, readers' photos will be published in the magazine and posted on our website. Get more information online at **ngm.com/yourshot.**

▶Tour more of Little Haiti through the images and words of two photo camp students in a multimedia show at **ngm.com/0602.**

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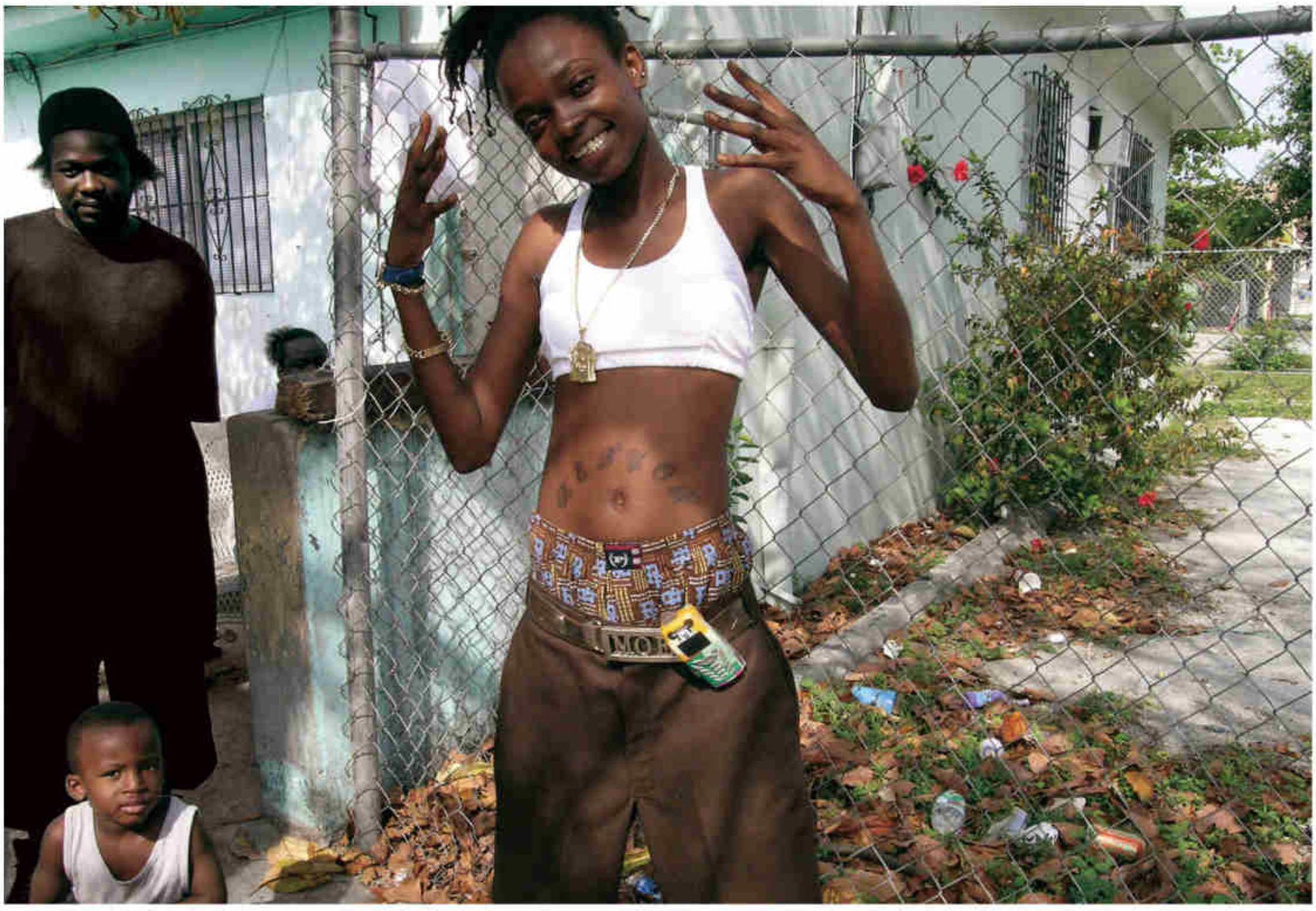
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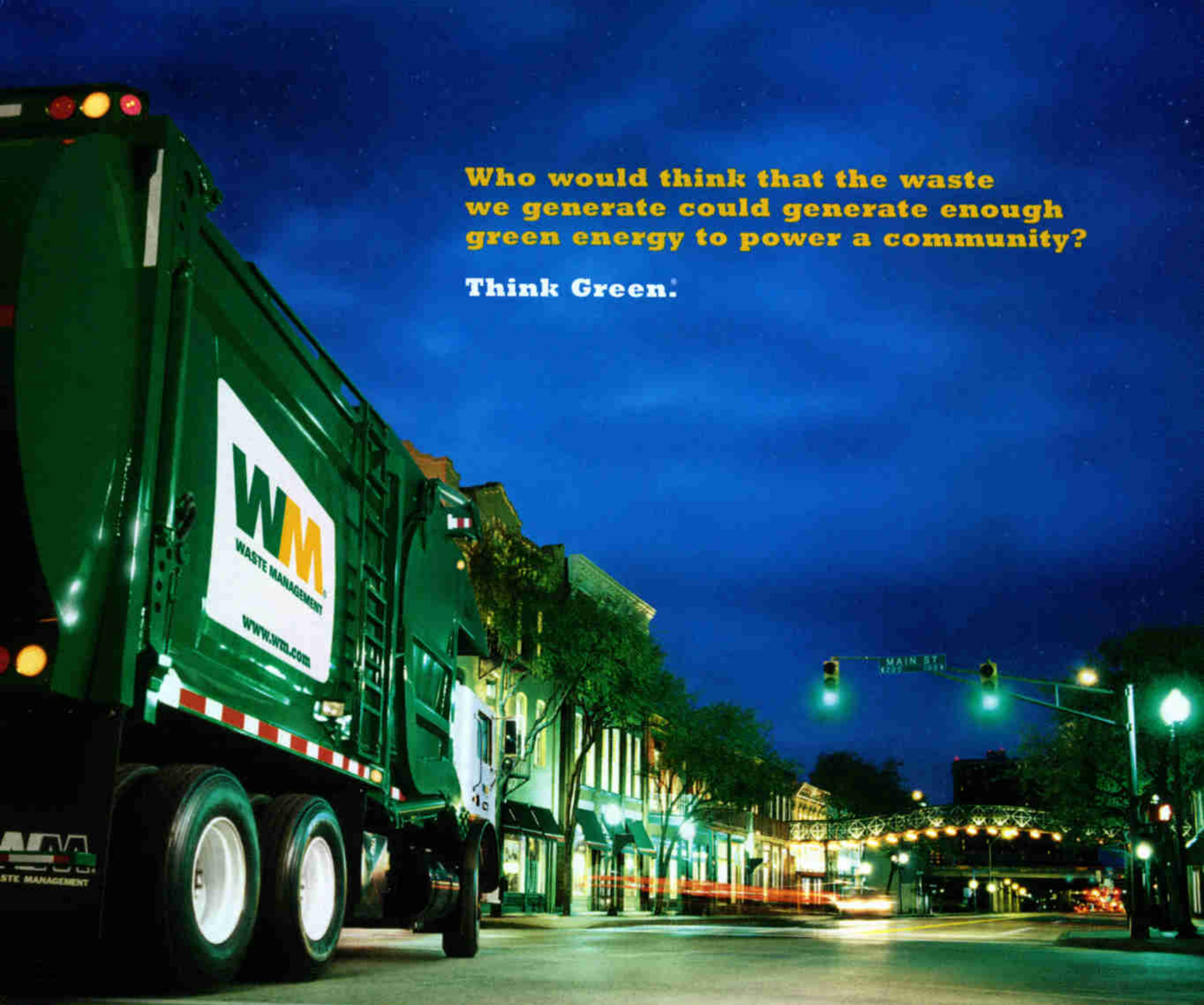


Squinting through a camera, students noticed characters and scenes they might normally ignore. When a man cruised past on his tricked-out bike, his stereo thumping, Francesca Philogene followed with her lens. "His bike was unusual," she says. "And I liked the song." The flair and smile of a young woman (below) caught Lucy David's eye along N.E. 56th Street. "Haitians are very passionate," David says.



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During a reenactment of Jesus' march to Calvary at Église Notre Dame d'Haiti on Good Friday, Bobbie Ann McGruder captured this image of a parishioner bearing a makeshift cross. At St. Mary's Cathedral, girls carry baskets of fruit on Easter morning. "Some people see Little Haiti as a bad place," says Nathalie Alcimé, a recent immigrant who photographed the girls. "But when you go there, you learn that isn't so. This was a day God was there." □



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LOVE

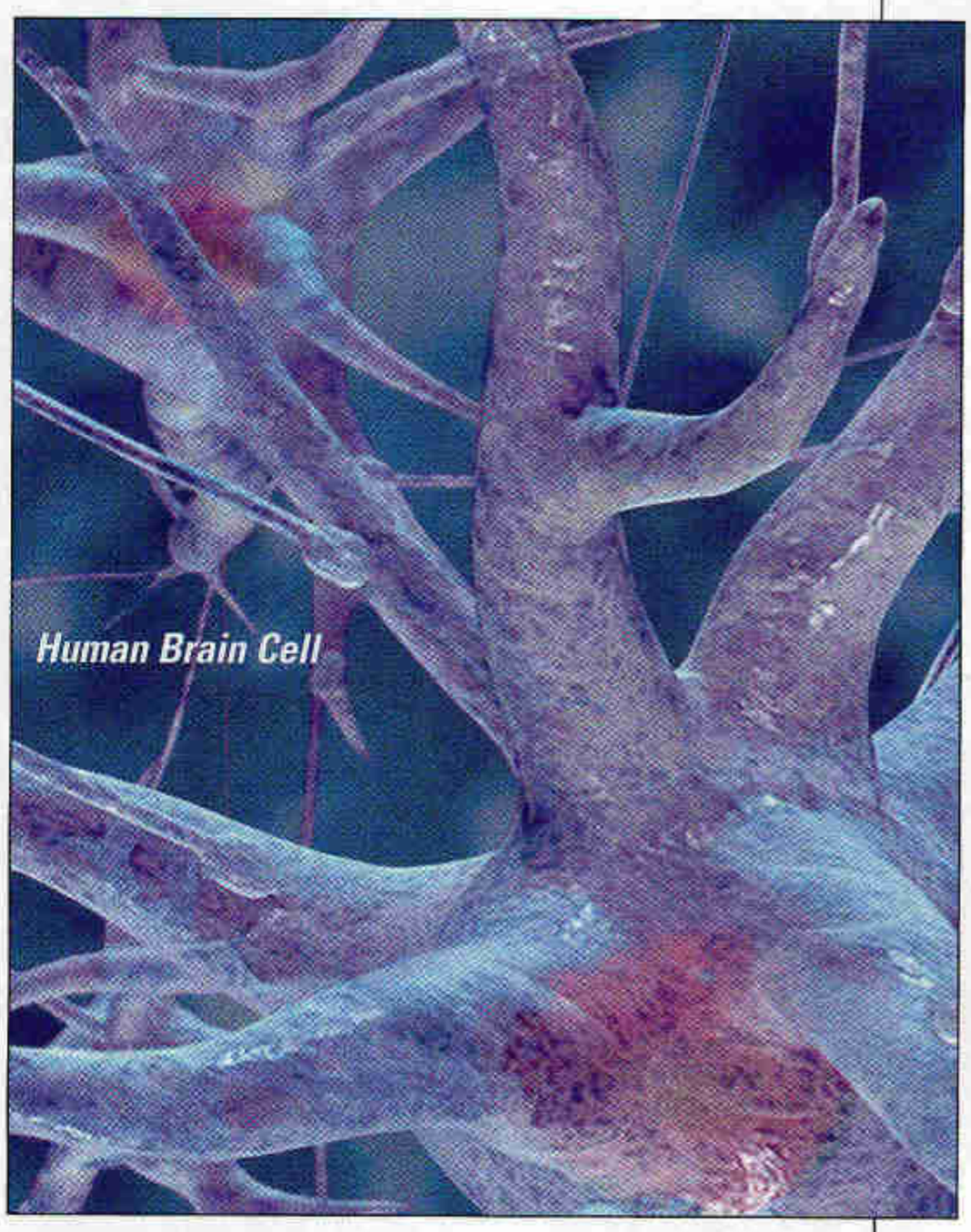
Searching for Romance

Sometimes love appears when it's least expected. By the time Jodi Cobb arrived in Florence, Italy, she'd already rounded the globe photographing courtship and marriage rituals for our article on the chemistry of love (page 32). She went to Florence to capture the essence of romance: "Italians take great pride in their reputation as lovers."

Wandering the streets on a hot summer afternoon, her eyes were drawn to the scene of a lone woman at a café. "I started taking pictures, thinking to myself, This is great, but it has nothing to do with the story. Then I noticed the headline and thought, Yes!" A phonetic rendering of "I love you," the headline tops an elaborate greeting card in the guise of a newspaper proclaiming the sender's passionate devotion.

ONLINE PHOTO GALLERY View Web-exclusive images with tips from photographer Jodi Cobb at **ngm.com/0602.**

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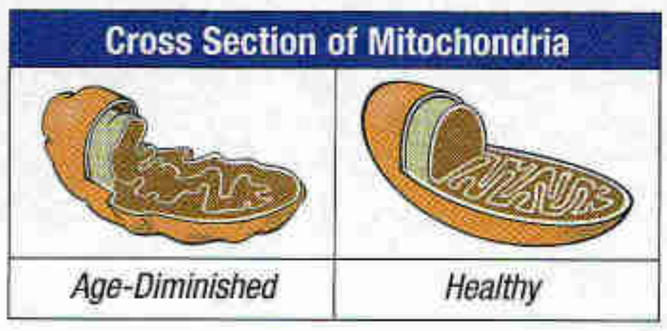
The Science of Aging.

Today scientists are attempting to challenge fate by investigating the secrets of aging. Dr. Bruce Ames, a renowned geneticist, leading biochemist and University Professor has been instrumental in researching the relationship between diet, maintaining healthy cells, and the aging process. His research links aging to tiny structures found inside cells called mitochondria.

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Do It Yourself

LOVE (SEE PAGE 32)



At Remote Lounge in New York City, patrons check each other out on video monitors before meeting in person.

Making an E-Match

Can we find true love through the computer? The kind that penetrates our souls and changes our lives utterly? Helen Fisher thinks we can. The Rutgers University professor, described as the "doyenne of desire" in this month's story about love, says that falling in love can be simply a matter of meeting a person who stimulates the right neurons.

"There will always be magic to love," Fisher says. "But the complex brain-body network that produces the elation, craving, and obsessive thinking associated with romantic love is just waiting to be triggered."

One U.S. company has used her research to launch a new matchmaking site called Chemistry.com. Users respond to a set of questions Fisher designed to capture their inner selves. ("Do you ever find yourself counting things?" Or, "Do you think it's important to do the right thing, even if it hurts others?") Their responses are then crunched and matched with other users'—perhaps with pyrotechnic results.

Chemistry.com is just the latest among Internet dating services, like PerfectMatch, TRUE, and the Christian-oriented eHarmony, claiming to have harnessed the science of compatibility. Their lengthy questionnaires are only a starting point, of course. Dating—and falling in love—remain activities best done in person.

THE RISE OF ONLINE DATING

Would-be lovers using Internet personals sites in the U.S. each spent an average of $67 in 2000. Last year they spent $99, making it a $500 million industry.



PICKS

Aphrodisiacs

Love potions, charms, and incantations designed to arouse desire have been around for millennia. Although modern science has debunked aphrodisiacs as a class, the reputations of the following have endured.

- **Chocolate** 17th-century writer James Wadsworth warned it would "make old women young and fresh; create new motions of the flesh." In fact, those Valentine's Day chocolates contain caffeine and other stimulants that may increase heart rate.
- **Chili peppers** The more fiery among them induce sweating, rapid heart rate, and flushing, all symptoms of sexual arousal.
- **Ginseng** There may be some truth to claims of its aphrodisiac powers: A 2002 study found Korean red ginseng was an effective treatment for erectile dysfunction.
- **Oysters** The bivalve's amorous reputation derives from its ties to Aphrodite, the ancient Greek goddess of love, who was born from the froth of the sea.

WEBSITE EXCLUSIVE

Why are love letters the rage in Nepal? Find out in the Learn More section of our "Love" story. **ngm.com/0602**

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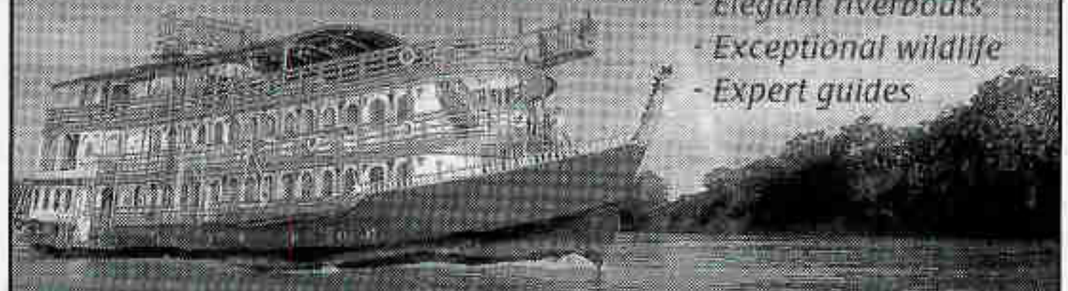
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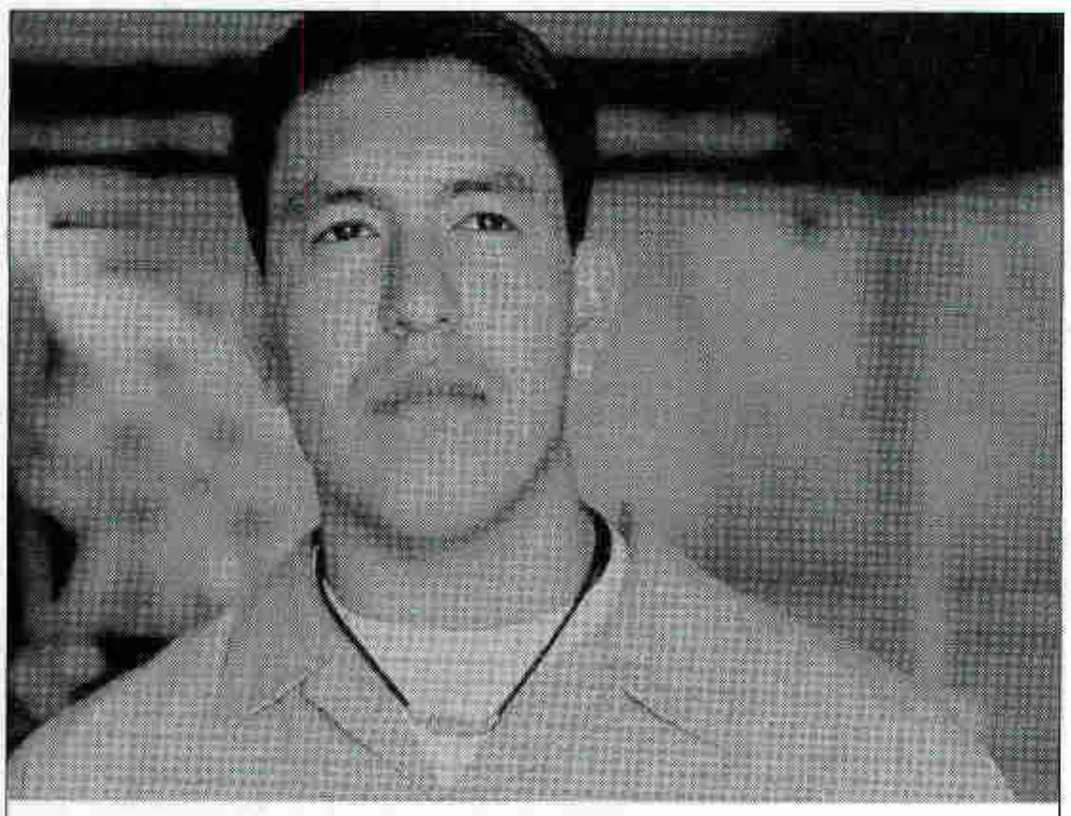
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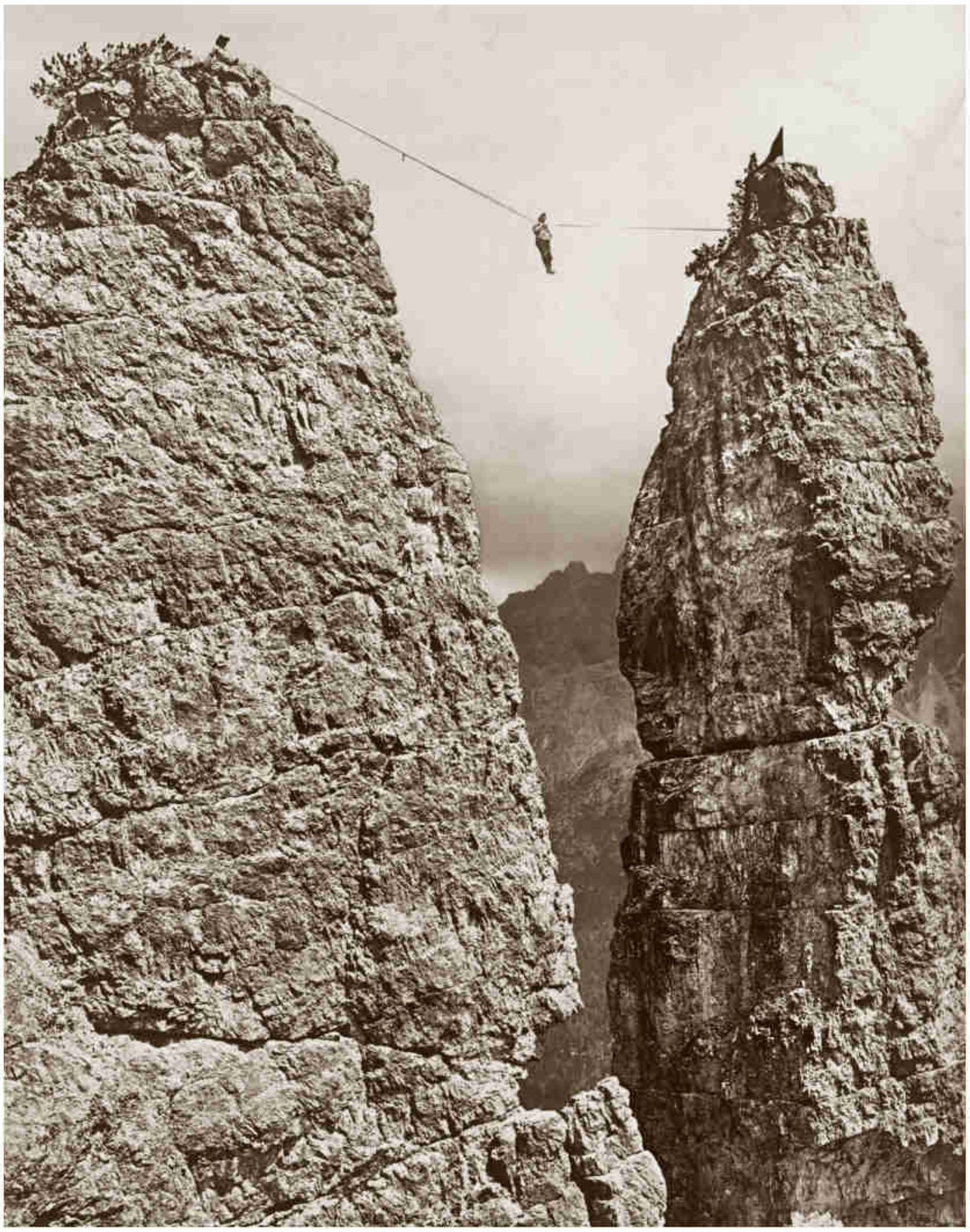
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Flashback



Mountaineers cross the gap between limestone spires in Italy's Dolomites.

ALPS

Hanging In There The names of these climbers are lost to history, but the photographic record of their feat—a 7,000-foot-high "Tyrolean traverse" rope ride from one pinnacle to another in the Italian Alps—lives on as published in the August 1913 issue of the GEOGRAPHIC. "Some idea of the difficulties of rock work can be formed from this picture," noted the photo's caption in the magazine. "The least mistake in swinging between the two peaks means instant death." *—Margaret G. Zackowitz*

▶ **E-GREET A FRIEND** with this image or other Flashback photos, in Fun Stuff at **ngm.com/0602.**

PHOTOGRAPHER UNKNOWN

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